RAILWAY ENGINEERING AND MAINTENANCE OF WAY.

WITH WHICH IS INCORPORATED

ROADMASTER AND FOREMAN

BRIDGES--BUILDINGS--CONTRACTING--SIGNALING--TRACK

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(Signed)
BRUCE V. CRANDALL, PUBLISHER.

Sworn to and subscribed before me this 31st day of March, 1915.
(Signed) Robert R. Grieg,
Notary Public.
(My commission expires Oct. 26, 1915.)

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The Engineering Association

The annual convention of the American Railway Engineering Association, held in Chicago, March 16 to 19, was the most successful convention yet held by this association both from the viewpoint of attendance and the scope of the committee reports. It is gratifying to note that a movement has been begun to inaugurate the change of the railway fiscal year to the calendar year. The question was raised that it would necessitate a change in the by-laws of nearly all the railways. *What if it does?*

There is no railway association that can so certainly show the saving of maintenance expense as this one, with the proposed change of the year. Why does not a committee of this association compile accurate figures showing this saving and then let the association present it to the American Railway Association in proper tabulated form? Then this association in turn can present it to the executives and boards of directors. The boards would assuredly welcome any proposal that would reduce the maintenance cost, and we feel certain the stockholders would. If decisive action was taken in this matter there is no reason why this should not be promulgated in order to have the by-laws changed at the coming annual elections.

It was interesting to note that some of the committees showed a tendency to collaborate with the United States Bureau of Standards. We have constantly recommended this, particularly as applicable to track scales, and think it the correct method of procedure, as there would be harmony and not friction between these two bodies. The Bureau of Standards is daily growing stronger and has even better facilities for carrying on elaborate tests than the Engineering Association. There are many subjects that are kindred, and purely technical specifications of both these bodies should coincide and one specification should answer for all, rather than a conglomeration for each individual to use.

It is to be regretted that it was not feasible for the committee handling the subject of track scales to submit a full report on the matter along with proposed standard specifications. This is a vital subject at present, as the existing specifications are unsatisfactory. The American Railway Association is revising their specifications and several of the big systems are doing likewise, in order that all manufacturers can bid on proposals. We wish to again reiterate our thought (expressed in former issues) on this matter and urge that after a proper reduction and assimilation has been made this should be taken up with the United States Bureau of Standards in joint committee session.

Railway Signal Association

The stated meeting of this association held on March 15 was well attended and brought forth more discussion and better committee reports than usual at this mid-year meeting. There seemed to be a tendency on the part of one of the committees to recommend the adoption of ideal conditions as pertaining to automatic block signals. This should be relegated to "adjuncts" or an account of the "possibilities of signaling." It must not be lost sight of that it is not now practicable to operate a single-track railway altogether by signals. To do so properly would entail the installation of such a complex system of automatic electric block signals, selective-train-dispatching-systems, and telephone system all interconnected and interlocked that the expense would not justify the end. Under present operating conditions it is necessary to have an intermediary to transmit some orders for train movements, at stated intervals, who may or may not have control of the switches. Broadly speak-

ing, lap sidings at intervals of ten miles with the necessary interlocking plants, the stop and stay signals connected with a selective-dispatcher's-system; the starting signals from passing tracks—controlled jointly by towerman and dispatcher; the intermediate block signals permissive, excepting those controlling intermediate passing tracks which should be controlled by the dispatcher—would bring about operating conditions that would be as near *ideal* as practicable. Even here it is problematical whether the expense of installation, maintenance and operation would be justified and it would not be best to resort to double track with proper automatic spacing signals. This is a deep and complex problem and has never been satisfactorily solved for all conditions. We are, of course, speaking of an extremely busy single-track line, in this instance, with a variegated freight traffic interspersed with a heavy and high-speed passenger traffic. An average single-track line could be operated now almost altogether by signals, economically if it was so desired.

The National Railway Appliances

This association had an unusually good exhibit during the meetings of the Signal Association and the Engineering Association. There were not as many exhibitors as last year, but the exhibits seemed to be on a sounder basis and fewer impracticable devices were shown. There were several new devices and numerous improvements on old that were all built on sound technical and practical principles.

Buy It Now

The "Buy It Now" campaign committee of Omaha, Nebraska, has been carrying on a vigorous campaign through the daily press and periodicals to create an optimistic feeling in business and start a general buying movement all along the line. This movement, although general in character, is directed more particularly at the farmers, on the assumption that they have more capital than anyone at present for investment. This placing of money in circulation, that is now dormant, will reflect in all business and industries, and create a strong stimulative effect. The committee uses the President's indorsement as its text: *"If you are going to buy it, buy it now. That is a perfectly safe maxim to act upon. It is just as safe to buy it now as it ever will be, and if you start to buying, there will be no end to it—and you will be a seller as well as a buyer."*

The railways have been helping the committee in every possible way by endorsement and the issuance of circulars and bulletins. The latest lines to issue bulletins being the Wabash, the Rock Island Lines and the Missouri, Kansas and Texas. This is a most excellent plan to re-create general business confidence and get us to turn our faces to our own internal affairs without so much speculation as to *what is going to happen* to business when the European cataclysm is finally halted. If the railways will, as soon as they are able, practice the doctrine they are promulgating and "BUY IT NOW," it will be the best possible stimulus general business and manufacturing can procure.

The Railway Signal Association

The Stated Meeting Mid-Year Held in Chicago on March 15, at Which Seven Committee Reports Were Presented and Discussed

The stated meeting of the Railway Signal Association was called to order at 9:30 a. m., on Monday, March 15, in the Auditorium Hotel, Chicago, by President T. S. Stevens, signal engineer of the Atchison, Topeka & Santa Fe. There were 230 members present. The following committees submitted reports for discussion: Committee II, Mechanical Interlocking, submitted specifications for electro-mechanical interlocking; Committee III, Power Interlocking, submitted specifications for incandescent electric lamps; Committee IV, Automatic Block, submitted specifications for grooved trunking and capping, and circuit requisites for single track, "traffic direction" automatic block signaling; Committee VI, Standard Designs, submitted 11 drawings, and revisions to plate 3, on Symbols; Committee VIII, Electric Railway and A. C. Signaling, reported progress; Committee X, Storage Battery and Charging Equipment, submitted specifications for Lead Type, Portable Storage Battery, and specifications for Lead Type, Stationary Storage Battery, not of the pure lead type. The Special Committee on Lightning Protection submitted requisites for lightning arresters and requisites for choke coils. The special committee on contracts submitted two tables of Operated Units for a Mechanical Interlocking Plant.

Results of Tonnage Rating

J. M. Daly, general superintendent of transportation, Illinois Central Railroad, says that "when an engine of 7 per cent more tractive power is turned over to the operating department, that department is called upon to haul 17 per cent more tonnage," and then presents the subject from the standpoint of the average operating man.

"Train tonnage resistance is composed of the following factors: Gravity, wheel friction, wind, temperature, speed, track, and gross weight of cars. The first, gravity, he considers the most important; next is the gross weight of cars, for the reason that light cars create much more resistance, per gross ton, in curves, wheel friction, wind and temperature than do the heavy cars; therefore, special allowance must be made for cars of different weights.

"The problem of determining the economic train load, and applying it in practice, has received careful study and consideration. As any other feature in connection with railroad operation, it is constantly considered month after month by the local division officers, as well as by the general officers of the individual roads, and it is frequently discussed at railroad association meetings and by railroad clubs until it has possibly been overdone.

"Our friends in the mechanical department have been increasing the tractive power of our locomotives and the capacity of our freight cars; our engineering departments have reduced grades and eliminated curves, until at this time it is an almost everyday occurrence to read in the daily papers and railroad journals where a single engine has hauled more than a hundred cars, with a gross weight of 5,000 or 6,000 tons, accomplishing far greater results than even the vivid imagination of men like Jules Verne could conceive of twenty-five years ago."

The University of Illinois, using a dynamometer car, made a test of thirty-two different trains to ascertain the number of pounds of tractive effort required for each ton of train in order to keep it in motion, on straight and level track, at uniform speed and in still air, and ascertained the following results:

At 15 miles per hour a 25-ton car has 7 pounds of tractive power per ton.

At 15 miles per hour a 50-ton car has 4¼ pounds of tractive power per ton.

At 15 miles per hour a 75-ton car has 3½ pounds of tractive power per ton.

At 30 miles per hour a 25-ton car has 9 pounds of tractive power per ton.

At 30 miles per hour a 50-ton car has 5½ pounds of tractive power per ton.

At 30 miles per hour a 75-ton car has 4½ pounds of tractive power per ton.

Showing it requires double the tractive power to move a gross ton of a 25-ton car than it does for a 75-ton car at the same speed.

The above tests do not represent the pounds of a drawbar pull used on curves or in grades. On this basis an engine rated for tonnage on a basis of 75-ton cars cannot haul the same tonnage in 25-ton cars.

Consider these facts when applied to mountain roads of sharp and continuous curvature, with constant changes of gradence over a division where the ordinary train may stand on from three to five curves at times while en route, most of which curvature is of a reverse nature, and one realizes the strain and lateral thrust that the equipment and track are subjected to. Then why wonder that under tonnage rating, theoretically applied, delays and grief may occur?

It is no theory that confronts the mountaineer.

Annual Banquet of Joint Committees

Committes No. 1 of Railway Signal Association and No. 10 of American Railway Engineering Association Hold Annual Dinner

The annual banquet of past and present members of the Railway Signal Association Committee No. 1 and the American Railway Engineering Association Committee No. 10 was held at the Congress Hotel on March 16th. It has been the practice for the past few years for these committees, which are composed of joint members, to hold this banquet in a "get together meeting" independently of the annual banquet of the Engineering Association. The members present were Azel Ames, sales manager, Kerite Wire Co.; C. C. Anthony, assistant signal engineer, Pennsylvania Railroad; C. A. Christofferson, signal engineer, Northern Pacific; W. J. Eck, signal and electrical engineer, Southern Railway; W. H. Elliott, signal engineer, New York Central; G. E. Ellis, signal engineer, Kansas City Terminal; C. E. Denney, assistant sales manager, Union Switch and Signal Co.; M. H. Hovey, signal engineer, Wisconsin Railroad Commission; J. C. Mock, signal engineer, Michigan Central; J. A. Peabody, signal engineer, Chicago and Northwestern; A. G. Shaver, consulting signal engineer; W. A. D. Short, editor, *Railway Engineering and Maintenance of Way;* Thomas S. Stevens, signal engineer, Santa Fe; H. H. Temple, chief engineer maintenance of way, San Antonio & Aransas Pass; E. F. Wendt, Engineering Board, Interstate Commerce Commission.

FAILURE OF THE PLAN TO MAKE THE RAILROADS CARRY THE PARCEL POST GRATIS

Washington dispatches printed in the newspapers brought the good news that a strong effort will be made in the new Congress to replace Representative Moon of Tennessee as Chairman of the Committee on Post Offices and Post Roads by a member who has some elementary notions of honesty and fair play. Mr. Moon has shown himself throughout the Congress just expired totally unfit for the position.

For two years he fought all orderly attempts to readjust the compensation of the railroads for carrying the mails. His latest endeavor was to attach a rider to the postoffice appropriation bill, giving the Postmaster General arbitrary power to set the figure for the pay of railroads. Mr. Moon admits the plan was to make the companies do the parcel post work gratis. He has asserted that the railroads receive $10,000,000 too much annually, and apparently the idea was to cut their pay by that amount in the coming year.

The outrageousness of the proposition will be evident to all fair minds. The business sense will grasp the general injustice of the parcel post situation. Those who have watched the long struggle of the roads for a little financial relief through the Interstate Commerce Commission will appreciate the truculence of an attempt to rob them of a good fraction of the relief through governmental injustice.

But the general anger and contempt for Mr. Moon's position seems to have reached its climax over the letter which he has written to Mr. Burleson, alleging that railroad influences defeated his rider, so that he and his clique decided to burke the appropriation bill altogether. The general testimony is that no underhand influence of any sort was used to beat the rider. It went down on its demerits, and any representation made by the railroads was not only within their rights, but their duty to save themselves from looting.—*New York Evening Sun.*

Record of Transportation Lines

A Report Published by the Pennsylvania Company Showing Miles of Railway Operated and Number of People Interested in the Company's Securities

On March 21, 1915, the Pennsylvania Railroad System issued its "Record of Transportation Lines," showing that it now has 26,419 miles of track in thirteen states, and the District of Columbia, the company also makes public a new compilation which brings out the fact that more than half of its 92,225 stockholders live in the states served by the railroad.

There are more owners of Pennsylvania Railroad stock today than ever before in the history of the company. On no other railroad in America—and probably in the world—are so many people dependent for a whole or part of their income. On March 1, the latest date for which figures have been compiled, 31,865 people who live in Pennsylvania—1,799 more than on March 1, 1914—are part owners in the Pennsylvania Railroad System. In New York 15,712 stockholders reside, while in New England and scattered throughout the rest of the country are 32,726 stockholders.

Despite the European war, the Pennsylvania Railroad on March 1 had 190 more foreign stockholders than it did a year before.

That there is a tendency for Pennsylvania Railroad stock to be held widely by small investors—those who put their savings in shares of the company—is indicated in the steadily decreasing average holding of shares. On March 1 the average holding was 108.27 shares, or 3.53 shares less than a year ago. The number of women shareholders is 44,469—almost half the total number, and their average holding is 63 shares.

The company's "Record of Transportation Lines" shows that the system now has 11,794.43 miles of line, of which 3,734.10 miles are double-tracked, 821.80 miles have three tracks, and 635 miles have four tracks. In addition there are 9,433.34 miles of side tracks, making a total of 26,419.24 miles of trackage.

The Pennsylvania System now operates in Delaware, the District of Columbia, Illinois, Indiana, Kentucky, Maryland, Michigan, Missouri, New Jersey, New York, Ohio, Pennsylvania, Virginia and West Virginia. In these states reside more than half of all the people in the United States.

THE ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION

The chairmen and many of the members of the standing committees of the Roadmasters' and Maintenance of Way Association met at the Auditorium Hotel the morning of March 17. The committee subjects and committee work for 1915 were discussed and suggestions given. The meeting was for the purpose of reviewing the work already done on the reports for the annual convention. A meeting of the executive officers was also held.

The Physical Valuation of the Railways

Contemplated Order of the Interstate Commerce Commission Asking for Relief by the Railways

It seems that the Interstate Commerce Commission is beginning to realize the enormous task that confronts them in valuing all the railroads of the United States, and are beginning to seek relief at the railroads' expense. The Commission, during the month of February, submitted to the President's Conference Committee four proposed orders, requiring:

(a) Preparation of inventories by the railroads themselves.

(b) Furnishing of motor car service by the railroads for the use of the valuation engineers of the Commission.

(c) Furnishing of information by the railroads as to the prices of material and labor.

(d) Preparation by the railroads of certain classes of leases.

(e) The information required under this section of the Act with reference to land grants, aids, gifts, donations, concessions, etc.

These are only proposed orders—feelers as it were—to determine the stand of the railroad managements in case the Commission should issue these orders, and also presumably to ascertain to what expense the railroads would be put in case the orders were enforced. In all it shows that the Commission is beginning to appreciate the hopelessness of doing the work itself and is calling for assistance and trying to unload the major part of it on the roads.

The proposed order requiring the railroads to prepare at the option of the Commission's Director of Valuation inventories of their property was stated by the director to refer specially to terminal property, but by its terms gives him the option of requiring the railroads to do all the cross sectioning and other inventory work.

The rough draft of the proposed order is as follows:

PROPOSED ORDER OF THE INTERSTATE COMMERCE COMMISSION.

It is ordered, that each and every carrier owning or operating a steam railroad, and each and every receiver or operating trustee of any such carrier shall prepare and file with the Commission a complete inventory of the quantities, units and classes and kinds of property in its roadway and track; bridges, buildings and all other structures; signals and interlockers; telegraph and telephone lines; electrical apparatus, and any and all fixed property except lands and equipment included in valuation orders No. 7 and

Such inventory shall be filed upon such dates, in such detail, upon such forms and for such part or parts of the property described below as the Director of Valuation shall require, provided that he shall allow in all cases a reasonable time for the preparation of such inventory which shall in no case be less than thirty days.

It is further ordered that the inventories herein required shall be made separately for the following accounts as described by the Interstate Commerce Commission in its Classification of Investment in Road and Equipment of Steam Roads effective July 1, 1914:

3 Grading.
4 Underground power tubes.
5 Tunnels and subways.
6 Bridges, trestles and culverts.
7 Elevated structures.
8 Ties.
9 Rails.
10 Other track material.
11 Ballast.
13 Right of way fences.
14 Snow and sand fences and snow sheds.
15 Crossings and signs.
16 Stations and office buildings.
17 Roadway buildings.
18 Water stations.
19 Fuel stations.
20 Shops and engine houses.
21 Grain elevators.
22 Storage warehouses.
23 Docks and wharves.
24 Coal docks and ore wharves.
25 Gas producing plants.
26 Telegraph and telephone lines.
27 Signals and interlockers.
28 Power dams, canals and pipe lines.
29 Power plant buildings.
30 Power substation buildings.
31 Power transmission systems.
32 Power distributing stations.
33 Power line poles and fixtures.
34 Underground conduits.
35 Miscellaneous structures.
36 Paving.
38 Roadways and small tools.
39 Assessments for public improvements.
43 Other expenditures—road.
47 Unapplied construction material and supplies.

Railway Construction

The Atchison, Topeka & Santa Fe, according to report, will construct a 20-mile line in the Oklahoma oil fields.

Construction of the government railroad in Alaska will be carried on by the Alaskan engineering commission, which surveyed possible routes, rather than under the engineer corps of the army.

It is probable that requests for bids for changing channel of the Mississippi river—the first work for the new Union Depot at St. Paul, Minn.—will be sent out soon.

The Balsam Lake & Eastern has applied to State Railroad Commission for authority to build railroad between Centuria and Balsam Lake, Wis. Grading will run about 12,000 cu. yds. per mile and no bridges will be required. W. R. Taylor, Balsam Lake, Wis., is president.

The Big Horn Canyon Power & Irrigation Co. is reported to have made surveys for electric railway from Hardin, Mont., to Custer.

The Engineering Association Convention

Excerpts from Reports of the Various Committees Presented at the 16th Annual Convention, March 16,1915

The Sixteenth Annual Convention of the American Railway Engineering Association opened at 9:35 a. m. on Tuesday, March 16, in the Florentine Room, Congress Hotel, Chicago. W. B. Storey, Jr., president, (vice-president Atchison, Topeka & Santa Fe), was in the chair. The minutes of the last annual meeting were approved.

The meeting was most successful and well attended, there being 490 members present and 340 at the annual banquet. The reports of committees and the discussions incidental thereto were expeditiously handled and the meeting adjourned on the afternoon of March 18, even earlier than anticipated.

ADDRESS OF PRESIDENT STOREY

Your Association during the past year has continued the work so well planned by the founders of the organization. The committees have worked with interest and zeal; reports have increased in volume, and as an indication of the interest being taken we find a tendency toward the publication of more and more data, all of it interesting.

The year that has passed has been one of stress in railway circles. The credit of the roads being impaired, money has been hard to borrow, and as a consequence the building of new lines has been curtailed and improvement of old ones has been impossible. This in turn has affected the general business of the country, and, with other causes not pertinent for discussion here, has made hard times, diminishing in turn the revenues of the roads and making economies necessary in every direction, and in many cases more than economies, viz., the postponement of work that must eventually be done in order to keep the roads up to the requisite standard.

The usefulness of your Association would be increased if we had more funds. We would, if we had it, spend money on many lines of investigation with profit to our profession, with credit to our organization and to the advantage of the railway interests of this country. The Association, however, has been compelled to restrict its work to the publication of reports by its committees except in cases where we have had outside help. We should publish a General Index, and it is the purpose of the Board to undertake this at an early date. It is true that we have accumulated something of a surplus, but the publication of a new edition of the Manual, together with the Index, will make large inroads on this surplus within the next year or two.

* * * * * * * *

As stated above, the work of your Association has been confined to publications except where we have had outside help. We have had this in the matter of the impact tests, which were undertaken a number of years ago, and more recently in our rail investigations. The American Railway Association has been bearing the expense of this work. Unfortunately for this work that Association has now withdrawn its support, and your Association is confronted with the necessity of stopping the work so well begun, and it is felt that the full benefit of the work already accomplished will be lost unless some arrangement can be made to carry it forward. We, as engineers, recognize that any improvement, no matter how small, in the matter of steel rails will justify any expenditure that has been or may be made, but the difficulty confronting us is convincing our operating people of this. The Executive Committee of the American Railway Association is charged with the responsibility of the expenditure of money, and its action has been taken because we have not convinced it that the expenditure pays. Possibly if we made individual effort with our operating superiors we might bring about a unanimity of action on the subject that, communicated to the Executive Committee, would change its present attitude, and it is requested that the members of your Association will do what they can in this direction.

There is one further subject to which the efforts of the individual members of the Association might be called, viz., the Fiscal Year. The Track Committee has recommended that it be changed and made coincident with the calendar year. It is true that some roads at the present time use this method of division. The majority of the roads, however, and the Interstate Commerce Commission make the fiscal year from July 1 to June 30. A search for reasons for this division has disclosed that it is largely a matter of custom. To change it, however, will be difficult owing to the necessity for changing the by-laws of practically all the roads in the country, together with dates of annual meetings. While the Interstate Commerce Commission has specified this particular division, it is felt that it did so for the sake of uniformity and because the greater part of the mileage of the country used it. The objections from a track maintenance point of view are very strong. Under the present method we are unable to plan intelligently the work for an entire season, which at its best is but short, and under present conditions work must often be abandoned after being begun, or possibly cannot be started until after the beginning of the new Fiscal Year. To make the change will take time and continued effort, but it is felt that our membership might accomplish much toward this end.

An inspection of the reports submitted for this convention will show an unusual amount of statistical data, principally tabulations of replies received by the respective committees in response to inquiries. It is believed that if your committees would give certain attention to condensing this data and showing same graphically, a very marked saving might be effected by diminishing the amount of our printing and the value of the information increased to those who have occasion to use it.

Probably your most important publication is the Manual, in that it embodies the principles which have been adopted as representing standard railway practice in this country. These vary, and must of necessity do so or there would be no progress. It is the intention, therefore, to republish the Manual as soon as possible after the convention, and it will contain the approved recommendations for the past sixteen years, and it may be said, without contradiction, that this volume will exemplify the best present practice for railway engineering and maintenance of way work.

While your work, as stated above, is circumscribed by lack of funds necessary for special research, the financial condition of the Association, due to the lines which have been followed, is gratifying, there being in the treasury at the close of the last calendar year over $17,000. The cost of republishing the Manual and the proposed General Index will reduce this, it is estimated, by about $7,000. It is to be hoped that the members of the Association will use every endeavor to increase the sale of publications.

It may be said that the European war is hardly one for consideration by a body of this kind, but the catastrophe is so great, and its influence will be so widespread, that it is of paramount interest even to an organization like ours. Railroad transportation has played a very important part in its prosecution.

Financial conditions have very seriously affected all railway and engineering construction during the past year, and as a consequence there is lacking the usual long list of notable achievements. One event stands out prominently, viz., the opening of the Panama Canal, which is so directly allied to our character of endeavor. This is now introducing economic features in the country's transportation problem which may have a farreaching effect, possibly changing a large element of the transportation of the country from rail to shipping, and incidentally raising questions of economical handling of freight at docks and wharves, and the attention of our members interested in this class of work is called to this fact. At the present time the overland roads are feeling seriously the inroads on the business formerly carried by them, and as the shipping interests are enlarged the subjects may be of even greater importance.

The valuation of railways under the Interstate Commerce Commission has begun in earnest. Parties have been and are at work in all parts of the country, and on some of the roads the work has progressed so far that the quantities are nearly complete. The principles to be followed are being worked out gradually, but there is still much to be determined. Our entire membership should be vitally interested in this work, involving, as it does, not only the actual measurement of earth work, but the more intricate determination of the face of the country before any construction was begun; the establishing of unit prices that include elements not used when the work was originally built, such as transportation; the fixing of land values, and, finally, questions of depreciation not only in the roadway and structures, but in equipment. All of these matters demand our earnest consideration, and as was pointed out by your President last year, your Association should lead in the study and consideration of the questions involved.

One of the small results of the European war in this country has been the curtailment of our supply of creosote from Germany, and this in turn has necessitated changing the methods of treatment of our ties. We could, of course, in time meet this by the manufacture of creosote in our own country, but manufacturers are hardly justified in undertaking this, as immediately on the cessation of the war we can look forward to the resumption of the low-priced German product.

RULES AND ORGANIZATION

G. D. Brooke (B. & O. S. W.), chairman; F. D. Anthony (D. & H.), vice-chairman; R. P. Black (K. & M), L. L. Beal (A. B. & A.), Ralph Budd (G. N.), A. M. Burt (N. P.), J. B. Carothers (B. & O. S. W.), S. E. Coombs (N. Y. C.), Curtis Dougherty (Q. & C.), B. Herman (Southern), Jos. Mullen (C. C. C. & St. L.), E. T. Reisler (L. V.), Committee.

The report of the Committee on Rules and Organization was the first submitted to the association. This committee had to review all rules and instructions heretofore adopted by the association, formulate rules for the guidance of the maintenance of way department pertaining to safety, and to continue the formulation of rules for the guidance of field parties. Fifteen "Safety Rules" for permanent way employes were recommended for adoption and printing in the Manual by the committee. The committee collected a large amount of additional data from the railways in regard to the forms of organization in use in the maintenance of way departments. An attempt to assemble data bearing on the historical aspect of the development of the present maintenance of way organizations has not met with much success, but further efforts will be made along this line. It is desirable to draw attention to the fact that several of the great railroad systems are making successful experiments in selecting and training men for positions in the maintenance of way department, and there is undoubtedly a growing tendency in favor of the systematic developing of men to supervise maintenance of way forces.

NEXT YEAR'S WORK

The following outline of work for next year is recommended:

(1) Review rules and instructions heretofore adopted by the association and recommend such changes and additions thereto as may seem desirable.

(2) Continue the formulation of rules for the guidance of field parties.

(a) When making preliminary surveys.
(b) When making location surveys.
(c) When in charge of construction.

(3) Continue the study of the science of organization.

(4) Report on the clearance of switchstands, signal stands, platforms, platform shelters, mail cranes, water columns, coal chutes, water tanks, etc., under the assignment from the Committee on Maintenance of the American Railway Association.

COMMITTEE No. X SIGNALS AND INTERLOCKING

The committee consisted of Thomas S. Stevens (A. T. & S. F.), chairman; C. C. Anthony (Penn. R. R.), vice-chairman; Azel Ames (Kerite Co.), H. S. Balliet (G. C. T.), J. B. Cameron (B. & O.), W. B. Causey, C. A. Christofferson (N. P.), C. E. Denney (U. S. & S. Co.), C. A. Dunham (G. N.), W. J. Eck (Southern), W. H. Elliott (N. Y. C.), G. E. Ellis (K. C. T.), M. H. Hovey (Consl. Engr.), A. S. Ingalls (L. S. & M. S.), A. M. Keppell (W. T.), J. C. Mock (M. C.), F. P. Pafenall (B. & O.), J. A. Peabody (C. & N. W.), D. W. Richards (N. & W.), A. H. Rudd (Penn.), W. B. Scott (S. P.), A. G. Shaver (Hallett Iron Works).

The committee was instructed to continue the study of Economics of Labor in Signal Maintenance, to formulate and present requisites for switch indicators, to present for approval specifications which had been previously adopted by the Railway Signal Association and which the committee considered would warrant consideration, and to study the problem of signaling single-track roads with reference to the effect of signaling and proper location of passing sidings on the capacity of the line.

The committee presented an amplification of the adjunct in the standard code and requisites for switch indicators which has been adopted by the Railway Signal Association.

The committee presented a table of operated units and points assigned to each unit as a revision of the Table of Units now included in the Manual. This was thought necessary because the present table does not take many electrical units into consideration and is therefore incomplete. The table presented not only brings the original table up to date in so far as the operated units are concerned, but assigns points to each unit which are more in accordance with the actual cost than does the present table.

The committee presented as information the findings of the joint committee of the American Railway Association on the subject of Automatic Control of Trains.

Fourteen members of the committee were present during the discussion, which was principally devoted to the advisability of accepting the committee's recommenda-

tion of printing in the Manual, the R. S. A. specifications for mechanical interlocking. The committee's recommendations and suggestions for the revisal of the Manual were finally adopted by the association.

UNIFORM GENERAL CONTRACT FORMS

This committee was composed of: E. H. Lee (C. & W. I.), chairman; C. A. Wilson (Cons. Eng.), vice-chairman; C. Frank Allen (Mass. Inst. of Tech.), W. G. Atwood (Interstate Commerce Commission), John P. Congdon (Cons. Engr.), Thos. Earle (Pa. Steel Co.), J. C. Irwin (B. & A.), R. G. Kenly (M. & St. L.), C. A. Paquette (C. C. C. & St. L.), J. H. Roach (L. S. & M. S.).

The committee was instructed to make a critical examination of the subject-matter in the Manual and submit definite recommendations for changes, and to continue the study of general forms, including the form of bond.

At the first meeting of the committee a form of bond was agreed upon, which has been unanimously approved by the members of the committee, and it is presented to the association with the recommendation that it be adopted.

BOND

KNOW ALL MEN BY THESE PRESENTS:

.....

That the undersigned.....
..... are held and bound unto the .....
..... in the sum of .....
..... dollars, lawful money of the United States of America, to be paid to said .....
its successors and assigns, to which payment the undersigned, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns.

The condition of this obligation is that if.....
CONTRACTOR shall faithfully furnish and do everything required in the contract, executed in writing, dated.....
191... between ..... Contractor, and
..... Company
for .....
this obligation shall become of no effect; otherwise it shall continue in full force.

Signed, sealed and delivered this ..... day of ..... 191...

ATTEST:

.....
.....

At the last two meetings of the committee the contract form printed in the Manual was carefully considered, and certain changes were agreed upon, as follows:

AGREEMENT FORM

THIS AGREEMENT, made this ..... day of
..... in the year .....
..... by and between .....
..... party of
the first part, hereinafter called the Contractor, and....
..... party of the
second part, hereinafter called the Company:

WITNESSETH, That, in consideration of the covenants and agreements hereinafter mentioned, to be performed by the parties hereto, and of the payments hereinafter agreed to be made, it is mutually agreed as follows:

The Contractor shall furnish all materials, superintendence, labor, equipment and transportation, except as hereinafter specified, and shall execute, construct and finish, in an expeditious, substantial and workmanlike manner, to the satisfaction and acceptance of the chief engineer of the Company, ...
.....
in accordance with the plans hereto attached identified by the signatures of the parties hereto, or herein described, and the following GENERAL CONDITIONS, requirements and specifications, forming part of this contract.

The work covered by this contract shall be commenced
.....
and be completed on or before the.....
..... day of .....191....
time being of the essence of this contract .....
.....

And in consideration of the completion of the work described herein, and the fulfillment of all stipulations of this agreement to the satisfaction and acceptance of the chief engineer of the Company, the said Company shall pay, or cause to be paid, to said Contractor, the amount due to the Contractor, based on the following prices:

.....

Eight members of the committee were present and with practically no discussion the proposed "Bond" form and "Uniform Contract Form" were adopted.

ECONOMICS OF RAILWAY LOCATION

This committee was composed of: John G. Sullivan (C. P. R.), chairman; C. P. Howard (Cons. Eng.), vice-chairman; F. H. Alfred (P. M.), R. N. Begien (B. & O. S. W.), J. F. Burns (L. & N.), Maurice Coburn (Vandalia), A. C. Dennis (Contr. Eng.), A. S. Going (G. T.), F. W. Green (L. & A.), L. C. Hartley (C. & E. I.), P. M. LaBach (C. R. I. & P.), Fred Lavis (Cons. Eng.), J. deN. Macomb, Jr. (A. T. & S. F.), C. W. P. Ramsey (C. R. R.), E. C. Schmidt (Univ. of Ill.), A. K. Shurtleff, H. J. Simmons (E. P. & S. W.), F. W. Smith (Contr. Eng.), Walter Loring Webb (Co*ns. Eng.), M. A. Zook (Interstate Commerce Commission).

The work assigned to this committee was as follows:

(1) Study the question of grade, curvature, rise and fall and distance, and, if possible, present conclusions as to reasonable values of same in a usable form, in order that they may be of use for the information and guidance of locating engineers.

(2) Continue the important study of economics of railway operation heretofore carried on by the committee, in order that the information may lead to more economical methods in railway operation, and that information may be obtained for correcting values given to the physical features in the locating of railways.

(3) Make special efforts to collect information in regard to effects of passenger and freight traffic on the cost of maintenance.

The chairman of the committee assumed the responsibility of changing the instructions to the sub-committee having charge of subject (1) to read, "Study the question of grade, curvature, rise and fall and distance, and, if possible, present instructions to enable engineers to obtain reasonable values for grade, curvature, rise and fall and distance."

If the methods outlined by this committee are approved, the immediate work for the future will be.

(1) Make a study of the resistance of trains running between 35 and 75 miles an hour.

(2) Make a study of the effect on the cost of maintenance of way and maintenance of equipment of fast trains.

(3) Make a study of the effect curvature has on the cost of maintenance of way.

(4) Make a study of the effect curvature has on the cost of maintenance of equipment.

(5) Make a study of the amount of fuel consumed in doing an actual horsepower-hour of work. It is believed that a study of this subject will not only be valuable as a basis in determining the economics of location,

but that the results will be beneficial to operating officers, calling to their attention various losses in the fuel supply, and especially so in the cost of operating a very busy single-track vs. the cost of operating double-track lines.

(6) Preparation of a method for the comparison of alternative locations with varying ruling gradients.

The conclusions submitted by the committee were scientifically and technically done. Eighteen conclusions in all were submitted and where possible formulæ that had already been adopted by the Association were used. The most notable of the conclusions submitted were numbers 3, 4, and 9. These were:

(3) The most general formula for the economic value of a location is:

$$\frac{R-E}{C}=p \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where R = Annual revenue (receipts from operation);
E = Annual expense of operation, including depreciation and taxes;
C = Capital invested (cost of construction);
p = Percentage of profit on investment.

(4) The following equation may be used in certain cases, especially where the annual revenue, known or unknown, is constant:

$$R-(E+I)=P \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where I = Amount of interest on cost of construction;
P = Amount of profit (net corporate income).

When the revenue is constant the condition of equation (2) is that the sum of operating expenses, plus interest on cost of construction, shall be a minimum, and is convenient in many cases, but does not indicate the proportion of profit to investment. Care should be taken not to use too low a rate of interest. The ratio of profit to investment should be considered.

(9) In deciding upon the ruling gradient for each engine district, where different ruling gradients are contemplated for adjoining districts carrying approximately equal traffic, due consideration must be given to the breaking up of trains, which may be caused by the difference in ruling gradients. Where a fixed elevation is to be overcome, the development of distance to reduce the rate of ruling gradient is often a mistake, provided the ruling gradient of the shorter line is within reasonable operating limits. Where curvature and distance are introduced for the sake of ruling gradient reduction, line resistance, and thereby fuel consumption, is increased, as is also the cost of maintenance of way and equipment. Some of the benefits derived from a reduction of the ruling gradient are the saving in weight of locomotives to be lifted over the summit, train and engine wages and engine mileage reduced and the capacity of the track increased. Full advantage cannot be taken of the apparent train rating increase due to ruling gradient reduction on an engine district having a large percentage of grade at or near the proposed ruling rate, as in all probability, if this anticipated increase in rating is in direct proportion to the proposed reduction in ruling gradient, the required time for movement of trains over the engine district cannot be made. On crowded single-track lines a feature affecting train rating to a great extent is the loss of time at meeting and passing points; it, therefore, is necessary to estimate the train rating for any line as the tonnage that can be handled in a given time, due allowance being made for necessary stops.

In estimating the time required for trains to pass over an engine district, a speed curve and time card should be plotted. There is little increase of tonnage for local and fast freights, and none for passenger trains, to be credited to a reduction of the ruling gradient on lines with light, undulating grades.

In establishing a ruling gradient and determining the effect of it on future operating expense, due consideration must be given to possible future revisions of the line; thus, in comparing alternative locations, one of steep ruling gradient may appear more economical than another of low ruling gradient, but the situation of the former may be such that its revision would necessitate an abandonment of all or a large percentage of the location; while the application temporarily of a steep ruling gradient to the low gradient location might bring the cost of the latter line within such limits that, considering future traffic, its construction would be desirable.

The first part of conclusion 9 brought forth a great deal of discussion, as it seemed to be understood to limit the tonnage of trains, and it was the opinion of some that the matter was disposed of too lightly.

SIGNS, FENCES AND CROSSINGS

This committee was composed of: W. F. Strouse (B. & O.), chairman; G. E. Boyd (D. L. & W.), vice-chairman; R. B. Abbott (P. & R.), H. E. Billman (M. P.), E. T. Brown (B. & O.), A. C. Copland (C. & O.), Arthur Crumpton (G. T.), J. T. Frame (C. G. W.), L. E. Haislip (B. & O.), Maro Johnson (I. C.), L. C. Lawton (A. T. & S. F.), G. L. Moore (L. V.), W. F. Purdy (W. P. T.), Thomas Quigley (I. C.), C. H. Splitstone (Erie).

The following work was assigned for the consideration of the committee:

(1) Report on the economy of concrete and metal signs and signals as compared with wood.

(2) Report on the economy of concrete and metal as compared with wood for fence posts.

(3) Investigate methods used and the comparative costs of repainting crossing and other signs; also present specifications for whitewashing cattle-guard wing fences.

The committee ascertained that the use of concrete and metal signs does not date back more than 12 or 15 years and in most cases is even less than that. In replies to queries fifteen roads reported using concrete signs, and thirty-nine the use of metal signs. These signs were in some cases wholly metal and in others a combination of metal with wood or concrete.

The committee is of the opinion that where either cast-iron or wrought-iron or steel signs are properly protected by paint and concrete, they will last as long as concrete and from two to three times as long as wood.

Tests of concrete posts which were begun last year were completed by this committee.

Tests of the reinforcement showed the following values of the yield point and the ultimate load:

Post.	Yield Point in lbs. per Sq. In.	Ultimate Load in lbs. per Sq. In.
M	98,800	106,700
N	75,700	83,600
O	.....	94,000
P	41,900	50,100
R	42,600	56,700
S	65,800	80,200

TABLE 8—TESTS OF REINFORCED CONCRETE FENCE POSTS.

Type of Post	M	N	O	P	R	S
Average weight in lbs.	115	147	75	80	90	150
Average breaking load, in cantilever test applied 48 in. above the ground line, in lbs.	420	231	325	185	335	135
Breaking load, as before, per lb. of post	3.68	1.57	4.33	2.31	3.72	.90

Estimated weight of reinforcement in lbs...	2.88	1.79	2.41	2.59	2.55	1.44
Breaking load, as before, per lb. of reinforcement	145	130	135	71	131	94

ROADWAY

This committee was composed of: W. M. Dawley (Erie), chairman; J. A. Spielmann (B. & O.), vice-chairman; J. R. W. Ambrose (G. T.), A. F. Blaess (I. C.), Ward Crosby (C. C. & O.), W. C. Curd (M. P.), Paul Didier (B. & O.), R. C. Falconer (Erie), S. B. Fisher (M. K. & T.), Frank Merritt (G. C. & S. F.), L. G. Morphy (B. & A.), F. M. Patterson (Interstate Commerce Commission), W. D. Pence (Interstate Commerce Commission), L. M. Perkins (H. P.), W. H. Petersen (C. R. I. & P.), A. C. Prime (P. R. R.), H. J. Slifer (Cons. Engr.), J. E. Willoughby (A. C. L.), W. P. Wiltsee (H. & W.), Committee.

The subjects assigned for consideration were:

(1) Continue the study of unit pressures allowable on roadbed of different materials, conferring with committee on Ballast and with special committee on Stresses in Railroad Track.

(2) Submit specifications for the protection of slopes by sodding or otherwise.

(3) Recommend means for the prevention or cure, as the case may be, of water pockets in roadbed.

(4) A petition signed by ten members of the Association, addressed to the Board of Directors, requesting the appointment of a special committee to investigate and report on the subject of separating the grades of roads and streets with railroads, was referred to this committee for such further investigation as might be deemed necessary or desirable.

A number of changes in the Manual were suggested, most of which were in wording only and did not affect the meaning to any great degree.

UNIT PRESSURES ALLOWABLE ON ROADBED OF DIFFERENT MATERIALS

The chairman of the sub-committee, J. R. W. Ambrose, has designed and tried out an apparatus for measuring under traffic the pressure at any point exerted by the ballast on the roadbed, which, when calibrated, gives promise of furnishing valuable information. No actual results in pounds per square foot have as yet been obtained.

An air-tight box is placed under the track in any desired position, the upper side of the box having a movable diaphragm. The spring within the box is to keep the diaphragm in the extended position after the load is removed. This box is connected by a pipe or hose to a similar box placed on edge, and having a thin rubber diaphragm; to the center of this diaphragm a connection is made to the side of a small mirror; thus any deflection of the diaphragm is multiplied by the mirror. A ray of light is passed on to the mirror, which in turn is deflected according to the magnitude of the impulse given this transmitter, onto a sensitized film moving at a constant speed, recording the movements of the light ray. In these experiments the transmitter was 12 in. under the tie, covered with gravel ballast; the recording mechanism was located 300 ft. from the track.

The committee endeavored to make a preliminary classification of soils preparatory to investigating allowable unit stresses thereon. In conclusion they requested that:

(1) That the classification of soils be adopted and included in the Manual.

(2) That the specifications for sodding with Bermuda grass be adopted and included in the Manual.

The Association voted that conclusion (1) be referred back to the committee and conclusion (2) be accepted.

RECORDS AND ACCOUNTS

This committee was composed of: W. A. Christian (I. C. C.), chairman; M. C. Byers (W. M.), vice-chairman; F. J. Bachelder (Cons. Engr.), W. S. Danes (Wabash), Lester Bernstein (B. & O.), G. D. Hill (I. C.), Huntington Smith (N. Y. C. & St. L.), Henry Lehn (N. Y. C.), J. H. Milburn (B. & O.), J. W. Orrock (C. P. R.), J. C. Patterson (Erie), H. C. Phillips (A. T. & S. F.), J. H. Reinholdt (M. & St. L.), R. C. Sattley (C. R. I. & P.), Guy Scott (P. L. W.), H. M. Stout (N. P.), Frank Taylor (C. R. R.), J. L. Vollintine (C. B. & Q.), W. D. Wiggins (P. L. W.).

The subjects assigned to the committee were:

(1) Make a comprehensive study of the forms in the Manual, adopted a number of years ago, and bring them up to date.

(2) Continue the study of reports required by Federal and State railway commissions.

(3) Continue the study of a feasible and useful subdivision of I. C. C. classification account No. 6, with a view to securing uniformity of labor costs.

The sub-committee appointed to deal with revision of the Manual and the study of the forms in the Manual suggested a few minor changes.

In connection with reports required by State and Federal Commissions, the committee feels that there is a diminution of the activities of the state commissions in connection with the valuation of railway property and a tendency on their part to await the valuation now in progress by the Interstate Commerce Commission.

SUB-DIVISIONS OF I. C. C. CLASSIFICATION ACCOUNT

Since this subject was assigned to the committee, the Interstate Commerce Commission has issued a new classification of operating expense accounts, which went into effect on July 1, 1914. In that new classification former account No. 6 has been divided into two parts—No. 202, Roadway Maintenance, and No. 220, Track Laying and Surfacing. The splitting of this account into two parts perhaps reduces the necessity of further sub-dividing the two new accounts. However, in the event that this further sub-division is desired, the following sub-divisions are submitted for consideration of the Association:

Account 202, Roadway Maintenance:

(A) Care of Roadbed;
(B) Bank Protection;
(C) Clearing and Cleaning Roadway and Track;
(D) Watching Roadway and Track;
(E) Flood Damage;
(F) Work Train Service.

Account 220, Track Laying and Surfacing:

(G) Renewing Track Material;
(H) Maintenance of Line and Surface;
(I) Other Expenses;
(J) Work Train Service.

The committee submitted for approval conventional symbols relating to "Rail," "Ballast," and "Electrified Lines." In the discussion it was brought out that the valuation engineers of the Interstate Commerce Commission were considering using the symbols that would be adopted by the Association. Therefore if they demanded the use of the symbols designating the weights of rail it would increase the cost to the railways. Therefore it was voted that the ballast symbols will be counted as approved, together with the symbols for electrified lines.

The suggested changes in the Manual were adopted. The suggestions under "Sub-divisions of I. C. C. Classification Account" were received as information.

TIES

This Committee was composed of: L. A. Downs (I. C.), chairman; G. W. Merrell (N. & W.), vice-chairman;

C. C. Albright (Purdue Univ.), W. A. Clark (D. & I. R.), E. D. Jackson (B. & O.), F. R. Laying (B. & L. E.), J. B. Myers (B. & O.), R. J. Parker (A. T. & S. F.), H. S. Wilgus (P. S. & N.), W. J. Burton (M. P.), S. B. Clement (T. & N. O.), E. P. Laird (A. C. L.), E. R. Lewis (D. S. S. & A.), J. V. Neubert (N. Y. C.), J. G. Shillinger (Rutland), Louis Yager (N. P.), and following subjects were assigned:

(1) Continue the study of the effect of the design of tie-plates and track spikes on the durability of cross-ties. (Not reported on.)

(2) Continue the study of the economy in track labor and material affected through the use of treated compared with untreated cross-ties.

(3) Continue the study of metal, composite and concrete cross-ties, building up a history of same.

(4) Investigate and report on the future timber supply for ties (not reported on).

(5) Report on the distribution and care of cross-ties.

The Committee presented formula for the tie costs that were adopted by the Association. This is:

Given:

R = Rate of interest;

C = Cost of tie of n years life;

C^1 = Cost of tie of n^1 years life.

Tie costs are equivalent when the capitalization or annual costs are equal, or

$$C^1 = \frac{C\,(1+R)n}{(1+R)n-1} \times \frac{(1+R)n^1-1}{(1+R)n^1} \quad \ldots\ldots\ldots (3)$$

The subjects on the use of metal, composite and concrete ties, and the distribution and care of cross ties was received as information.

IRON AND STEEL STRUCTURES

This Committee was composed of: A. J. Himes, chairman (N. Y. C. & St. L.); O. E. Selby, vice-chairman (C. C. C. & St. L.); J. A. Bohland (G. H.), W. S. Bouton (B. & O.), A. W. Buel (Cons. Eng.), A. W. Carpenter (N. Y. C.), Charles Chandler (I. C.), C. L. Crandall (Cornell Univ.), J. E. Crawford (N. & W.), F. O. Dufour (Interstate Commerce Commission), W. R. Edwards (Interstate Commerce Commission), A. C. Irwin (C. M. & St. P.), B. R. Leffler (N. Y. C.), W. H. Moore (N. Y., N. H. & H.), P. B. Motley (C. P. R.), Albert Reichmann (Am. Br. Co.), C. E. Smith (M. P.), H. B. Stuart (G. T.), G. E. Tebbetts (K. C. T.), F. E. Turneaure (Univ. of Wis.), L. F. Van Hagan (Univ. of Wis.).

The subjects assigned to the Committee were:

(1) Report on the methods of protection of iron and steel structures against corrosion.

(2) Study designs and report on built-up columns, co-operating with other investigators and committees of other associations.

(3) Report on the design, length and operation of turntables.

(4) Report on the relative economy of various types of movable bridges.

Other subjects continued from the preceding year were:

(5) Investigation of secondary stresses and impact.

(6) Adaptation of designs of movable bridges to signal and interlocking appliances required.

(7) An elastic requirement for steel.

(8) Bridge clearance diagram.

The committee recommended that the following action be taken on the report:

(1) That the report on methods of protection of iron and steel structures against corrosion be received as information.

(2) That the report on the design of built-up columns be received as a progress report.

(3) That the report on the design, length and operation of turntables be received as a progress report.

(4) That the report on the relative economy of various types of movable bridges be received as a progress report.

(5) That the report on secondary stresses and impact be received as a progress report.

(6) That the report on the adaptation of designs of movable bridges to signal and interlocking appliances required be received as a progress report.

(7) That the specifications for an elastic strength requirement for steel be adopted and printed in the Manual.

(8) That the bridge clearance diagram shown be adopted by the Association and substituted for the diagram now published in the Manual; also that a footnote be added to the specifications calling attention to the recommendations of the Committee on Electricity for a clear height of 25 ft. in electrified zones.

The Committee secured the co-operation of the United States Bureau of Standards in subject No. 2, as the Bureau had made some elaborate tests in 18 different types of columns.

The Association received as a progress report the findings of the committee on proposed standard turntables, as was also the "Investigation of secondary stresses and impacts."

Mr. R. W. Carpenter moved that in requirement (6): The bridge operating functions shall be interlocked with the signal system in such a manner that none of the functions for opening can be performed until the signals controlling the movement of trains over the draw have been set at stop indication and so that the signals cannot be set at proceed indication until all of the functions for closing have been completed. The bridge operating functions shall be interlocked with each other so that they must be performed in a predetermined order, both for opening and for closing. This was adopted by the Association.

In requirement (7) Mr. Carpenter also moved that: "In eye-bar tests, the minimum ultimate strength shall be 55,000 lbs. per sq. in., and the minimum yield point, as indicated by the drop of the beam or of the mercury column of the testing machine, shall be 29,000 lbs. per sq. in. Bars shall generally break in the body and the fracture shall be silky or fine granular, should a bar break in the head and develop the specified elongation, ultimate strength and character of fracture, it shall not be cause for rejection, provided not more than one-third of the total number of bars break in the head." After some further discussion this was adopted by the Association.

The Association would not adopt the motion to make bridge clearances 15 feet.

RAIL

This committee was composed of: J. A. Atwood (P. & L. E.), chairman; W. C. Cushing (P. L. W.), vice-chairman; E. B. Ashby (L. V.), A. S. Baldwin (I. C.), Chas. S. Churchill (N. & W.), J. B. Berry (Cons. Engr.), G. M. Davidson (C. & N. W.), Dr. P. H. Dudley (N. Y. C.), C. F. W. Felt (A. T. & S. F.), L. C. Fritch (C. N.), A. W. Gibbs (P. R. R.), A. H. Hogeland (G. N.), C. W. Huntington (M. & St. L.), John D. Isaacs (S. P.), Howard G. Kelley (G. T.), C. F. Loweth (C. M. & St. P.), H. B. MacFarland (A. T. & S. F.), R. Montfort (L. & N.), C. A. Morse (C. R. I. & P.), J. R. Onderdonk (B. & O.), J. P. Snow (Cons. Engr.), F. S. Stevens (P. & R.), A. W. Thompson (B. & O.), R. Trimble (P. L. W.),

Geo. W. Vaughan (N. Y. C.), M. H. Wickhorst, and were instructed to:—

(1) Recommend standard rail sections.

(2) Continue investigations of rail failures and deduce conclusions therefrom.

(3) Continue special investigation of rails.

(4) Present specifications for material in rail joints.

Proposed dimension of cross sections of rails of different weight were presented by the committee as shown in the following table:

Investigation showed that not enough rail of the A. R. A. section had been laid to give comparative results of any value between the sections "A" and "B" that were adopted in 1908.

The committee reported that the best and most economical lengths of rail was a matter for further study as the character of the major portion of the present equipment might render inadvisable the use of rail lengths more than 36 ft. or 39 ft.

The following specifications are presented for adoption:

(a) Specifications for High Carbon Steel-Joint Bars.

(b) Specifications for Heat-Treated, Oil-Quenched Steel-Joint Bars.

(c) Specifications for Medium Carbon Steel Track Bolts with Nuts.

(d) Specifications for Heat-Treated Steel Track Bolts with Nuts.

In conclusion the committee recommended the adoption of the following:—

First. (a) That the sections of rails recommended for weights of 100, 110 and 120 lb. per yd. be approved as standard and printed in the Manual.

(b) That the A. R. A.-A. section be adopted as standard for 90-lb. rails.

(c) That for sections below 90 lbs. it is inadvisable to recommend any changes in the sections now in use.

(d) That the above conclusions be presented to the A. R. A. for adoption.

Second, that the specifications for material in Joint Bars be adopted and printed in the Manual.

Third, that the revisions of the specifications for Carbon Steel Rails be adopted and printed in the Manual.

The Association adopted paragraphs a, b, c, and d of the committee's conclusions.

The investigations of the Rail Failures and the conclusions deducted therefrom were received as information as was the work on the special investigation of rails.

The specifications for high carbon steel joint bars and for heat-treated, oil-quenched steel joint bars were adopted. In addition the recommended changes in the Manual were adopted.

TRACK

This committee was composed of:— J. B. Jenkins (B. & O.), chairman; G. J. Ray (D. L. & W.), vice-chairman; Geo. H. Bremner (I. C. C.), H. M. Church (B. & O.), Garrett Davis (C. R. I. & P.), J. M. R. Fairbairn (C. P. R.), T. H. Hickey (M. C.), E. T. Howson (Railway Age Gazette), L. J. Hughes (C. R. I. & P.), T. T. Irving (G. T.), J. R. Leighty (M. P.), A. C. Mackenzie (C. P. R.), P. C. Newbegin (B. & A.), F. B. Oren (I. C.), R. M. Pearce (P. & L. E.), H. T. Porter (P. & L. E.), E. Raymond (A. T. & S. F.), W. G. Raymond (Univ. of Iowa), S. S. Roberts (Cons. Engr.), L. S. Rose (C. C. C. & St. L.), H. R. Safford (G. T.), C. H. Stein (C. R. R. of N. J.), A. H. Stone (K. C. Term.), W. I. Trench (B. & O.).

An elaborate report was submitted with drawings of double slip crossing layouts and double crossovers for adoption. Drawings for typical solid manganese frogs were also submitted. The committee recommended that:—

(1) Drawings of typical layout of Nos. 8, 11 and 16 double-slip crossings, movable points be operated by interlocking plant.

(2) Drawings of spacing of ties for switches to be operated by hand and by interlocking plant when No. 1 rod is used as lock rod.

(3) Drawings of typical layout of Nos. 8, 11 and 16 double cross-overs be received as information.

The report on Economies of Track Labor be received as a progress report.

Section	90-lb.	100-lb.	110-lb.	120-lb.	130-lb.	140-lb.
A	5-1/8"	5-3/8"	5-1/2"	5-3/4"	6"	6-1/4"
B	5-5/8"	6"	6-1/4"	6-1/2"	6-3/4"	7"
C	2-9/16"	2-11/16"	2-25/32"	2-7/8"	2-15/16"	3"
D	9/16"	9/16"	19/32"	5/8"	21/32"	11/16"
E	2-35/64"	2-3/4"	2-53/64"	2-59/64"	3-1/32"	3-9/64"
F	2-29/32"	2-31/32"	3-1/8"	3-1/4"	3-3/8"	3-1/2"
G	3/8"	3/8"	3/8"	3/8"	1/2"	1/2"
I	3/8"	5/8"	5/8"	5/8"	3/4"	3/4"
K	1"	1-1/16"	1-1/8"	1-3/16"	1-7/32"	1-1/4"
M	3-5/32"	3-9/32"	3-13/32"	3-17/32"	3-11/16"	3-27/32"
P	1-15/32"	1-21/32"	1-23/32"	1-25/32"	1-27/32"	1-29/32"
Actual Weight (lb.)	89.96	101.49	110.36	120.87	129.64	138.52
Area Head (sq.in.)	3.20	3.80	4.04	4.40	4.63	4.93
Per Cent	36.2	38.2	37.4	37.1	36.4	36.3
Area Web (sq.in.)	2.12	2.25	2.49	2.69	3.02	3.28
Per Cent	24.0	22.6	23.0	22.7	23.8	24.1
Area Base (sq.in.)	3.50	3.90	4.29	4.76	5.06	5.37
Per Cent	39.8	39.2	39.6	40.2	39.8	39.6
Total Area (sq.in.)	8.82	9.95	10.82	11.85	12.71	13.58
Moment of Inertia	38.7	49.0	57.0	67.6	77.4	89.2
Sect. Mod., Head	12.56	15.1	16.7	18.9	20.8	23.1
Sect. Mod., Base	15.23	17.8	20.1	23.1	25.6	28.4
Ratio M.I. to Area	4.39	4.92	5.27	5.71	6.09	6.56
Ratio Sec.Mod.to Area	1.42	1.52	1.55	1.59	1.64	1.70

Table Showing Proposed Rail Sections A. R. E. A.

Recommendations for adoption by the Association were:—

(1) That it is very desirable that there be defined standards for the manufacture of manganese frogs and crossings.

(2) That drawings Nos. 1, 2, 3, 4, 5, 6 and 7 and specifications for solid frogs, rail-bound frogs and sections for solid crossings, Manganese Track Standards, appear to be satisfactory and that they be placed in general use as representing minimum sections, but they be not incorporated in the Manual for the present.

(3) That all frog, crossing or other track structures manufactured in accordance with these designs and specifications be stamped with the manufacturer's name and the initials "M. T. S.," signifying Manganese Track Specifications.

To be published in the Manual:—

(1) Drawings of typical layout of Nos. 8, 11 and 16 double-slip crossings to be operated by hand as representing good practice for hand-thrown double-slip crossings.

"The portion of the report dealing with 'The Economies of Track Labor' was adopted."

The portion of the report dealing with the drawings of typical layout Nos. 8, 11 and 16, was referred back to the committee for further consideration in conference with the Railway Signal Association.

CONSERVATION OF NATURAL RESOURCES

This committee was composed of: C. H. Fisk (Cons. Eng.), chairman; A. W. Carpenter (N. Y. C.), vice-chairman; R. H. Aishton (C. & N. W.), Moses Burpee

(B. & A.), F. F. Busteed (C. P. R.), A. L. Davis (I. C.), W. A. Hammel, William McNab (G. T.), A. L. Moorshead (Erie), Francis Lee Stuart (B. & O.), S. N. Williams, R. C. Young (L. S. & I.).

The work assigned was:

(1) Continue the study of tree planting and general reforestation.

(2) Continue the study of coal, fuel-oil and timber resources.

(3) Continue the study of iron and steel resources.

The committee collaborated with the reports of the U. S. Geological Survey and the work in progress by the forest service of the United States Department of Agriculture, and found the loss $75,000,000 annually because 40,000,000 acres of divided forest lands were unproductive, and that increases must be made in anthracite coal production to meet the future demands resulting from natural progress. The recommendations of the committee were adopted by the Association.

BUILDINGS

This committee was composed of: M. A. Long (B. & O.), chairman; G. H. Gilbert (B. & O.), vice-chairman; G. W. Andrews (B. & O.), C. H. Fake (M. P. & B. T.), J. P. Canty (B. & M.), E. A. Harrison (A. T. & S. F.), D. R. Collin (N. Y. C.), A. T. Hawk (C. R. I. & P.), W. H. Cookman (P. R. R.), H. A. Lloyd (Erie), C. G. Delo (C. G. W.), P. B. Roberts (G. T.), W. T. Dorrance (E. B. T.), W. S. Thompson (P. R. R.), They recommended numerous changes in the Manual, as to engine house design, turntable pit, door openings, lead tracks to turntables, etc.; the method of heating for medium sized stations; methods of lighting medium sized stations; sanitary provisions for medium sized stations.

The Association approved the recommendations of the committee.

WOOD PRESERVATION

This committee consisted of: Earl Stimson (B. & O.), chairman; E. H. Bowser (I. C.), vice-chairman; H. B. Dick (B. & O. S. W.), C. F. Ford (C. R. I & P.), Dr. W. K. Hatt (Purdue Univ.), V. K. Hendricks (St. L. & S. F.); George E. Rex (A. T. & S. F.), E. A. Sterling (Cons. Engr.), C. M. Taylor (P. & R.), C. H. Teesdale, Dr. H. von Schrenk (Cons. Engr.), T. G. Townsend (Southern).

The work assigned to them was:

(1) The use of coal tar in creosote.

(2) Water in creosote.

(3) Compilation of information from service tests and reports of inspections of sections of test track.

The following specifications for a creosote-coal tar solution was recommended:

"The oil shall be a pure coal-tar product, consisting only of coal-tar distillates and oils obtained by the filtration of coal tar. It shall contain no admixture of crude tar.

"Water shall not exceed 2 per cent.

"Specific gravity at 38 deg. C. shall not be less than 1.03 nor more than 1.10.

"Matter insoluble on hot extraction with benzol shall not exceed 2 per cent.

"The specific viscosity (Engler) at 82.3 deg. C. (180 deg. F.) shall be not more than 1.170 for 200 cc. No variation above this standard shall be allowed. The term, 'Specific Viscosity,' in this case shall mean the number of seconds found for the sample tested, divided by the number of seconds for water at 20 deg. C. given in the official certificate for the viscosimeter used.

"On distillation by the standard method of the American Railway Engineering Association, it shall yield the following fractions based on dry oil:

"Not more than 1 per cent at 170 deg. C.

"Not more than 5 per cent at 210 deg. C.

"Not more than 30 per cent at 235 deg. C.

"The residue at 355 deg. C. shall not exceed 26 per cent."

The committee recommended the following four rules relative to water in creosote be adopted.

ALLOWABLE LIMITS OF WATER

(1) The use of creosote in treatment containing up to 3 per cent water is permissible. Where the quantity exceeds 3 per cent, proper allowance shall be made, but under no circumstances shall timbers be treated with oils having more than 6 per cent water.

MEASUREMENT OF OIL

(2) In all cases where water separates from the oil in the tank or car, the water should be taken off to as great an extent as practicable and the oil measurement then should be made from the point of separation between the remaining water and oil as nearly as this can be determined. This refers to the physical process of measurement.

SAMPLING OF OIL FOR WATER CONTENT

(3) In sampling oil a drip sample should be used in taking samples from cylinders during treatment, and an approved cross-section tube should be used for taking samples from tanks or tank cars.

STORAGE TANKS

(4) All storage tanks should have a watertight roof.

BALLAST

This committee was composed of: H. E. Hale, chairman; J. M. Meade, vice-chairman, (A. T. & S. F.); L. W. Baldwin (I. C.), D. P. Beach (P. L. W.), W. J. Bergen (N. Y. C. & St. L.), T. C. Burpee (Cons. Eng.), O. H. Crittenden (I. & G. N.), J. M. Egan (I. C.), T. W. Fatherson (C. G. W.), H. L. Gordon (B. & O.), Geo. H. Harris (M. C.), C. C. Hill (M. C.), S. A. Jordan (B. & O.), William McNab (G. T.), S. B. Rice (R. F. & P.), E. V. Smith (B. & O.), D. L. Sommerville (N. Y. C.), F. J. Stimson (G. R. & I.), D. W. Thrower (I. C.), R. C. White (M. P.).

The work assigned to the committee was:

(1) Continue the investigation of the proper depth of ballast of various kinds to insure uniform distribution of loads on roadway, conferring with other committees.

(2) Continue study of subject of ballast sections, with particular reference to the use of a sub and top ballast.

The specifications recommended were:

GRAVEL BALLAST

Class A Roads: Bank gravel, which contains more than 2 per cent of dust or 40 per cent of sand, should be washed or screened. Washed or screened gravel should contain not less than 25 per cent, nor more than 35 per cent sand. Class B Roads: Bank gravel which contains more than 3 per cent of dust or 60 per cent of sand should be screened or washed. Washed or screened gravel should not contain less than 25 per cent or more than 50 per cent of sand. Class C Roads: Any material which makes better track than the natural roadbed may be economically used.

BURNT CLAY BALLAST

Kind of Material.—Good ballast clay should be heavy and plastic, free from sand, gypsum or other impurities; must not crumble when exposed to air or brought in contact with heat.

Location.—The pit must be located on level or moderately sloping ground, not subject to overflow. A water supply is desirable and it must be borne in mind that the sulphurous and carbonaceous gases liberated during

the burning period damage the surrounding vegetation and make habitation in the near vicinity very disagreeable.

Test.—The location site should be thoroughly tested to determine the quality of clay, the depth and uniform consistency of the deposit and small quantities should be burned in test kilns to show the quality of ballast to be secured.

BURNING

Fuel should be fresh, clean slack and arrangements should be made to secure a constant supply. One ton of slack coal is sufficient for the perfect burning of four cubic yards of acceptable ballast. From 1 to 1½-in. layer of slack are alternated with from 10 to 12-in. layers of clay, a new layer of slack and clay being applied to the fire every five or six days. Fires once started must be kept steadily and uniformly burning. To insure thorough and proper burning of the clay, the top and face of the first must be frequently raked down, to avoid clinker or black spots, caused by too much or too little air. When fully burnt a proper ballast clay becomes red in color, due to its high percentage of iron compounds; when underburnt the clay will show a yellow color.

Size.—Burnt clay ballast should be crushed or broken, if necessary, so that the largest piece will pass through a 4-in. ring.

Density.—The finished product should absorb not to exceed 15 per cent of moisture by weight.

The specifications for gravel ballast were adopted and for burnt clay and ballast sections were referred back to the committee.

STRESSES IN RAILROAD TRACK

This was a special committee that have been developing proper instruments for carrying on this work and starting a field party for tests which have proved that the methods used are practicable. Arrangements have been made for tests on the Baltimore and Ohio and the Delaware, Lackawana and Western.

The Engineering Experiment Station of the University of Illinois is co-operating with the committee on this work through the use of its laboratories and its staff in the development of apparatus and methods of tests.

The committee was composed of: A. N. Talbot (Univ. of Ill.), chairman; W. M. Dawley (Erie), vice-chairman; A. S. Baldwin (I. C.), J. B. Berry (Cons. Engr.), G. H. Bremner (I. C. C.), John Brunner (Ill. Steel Co.), W. J. Burton (M. P.), Chas. S. Churchill (N. & W.), W. C. Cushing (P. L. W.), P. H. Dudley (N. Y. C.), H. E. Hale, Robt. W. Hunt (Cons. Eng.), J. B. Jenkins (B. & O.), Geo. W. Kittredge (N. Y. C.), P. M. LaBach (C. R. I. & P.), C. G. E. Larsson (Am. Br. Co.), William McNab (G. T.), G. J. Ray (D. L. & W.), A. Reichmann (Am. Br. Co.), E. Stimson (B. & O.), F. E. Turneaure (Univ. of Ill.), J. E. Willoughby (A. C. L.).

MASONRY

This committee was composed of: F. E. Schall (L. V.), chairman; F. L. Thompson (I. C.), vice-chairman; R. Armour (G. T.), J. C. Beye (C. R. I. & P.), C. W. Boynton, H. A. Cassil (B. & O. S. W.), T. L. Condron (Cons. Engr.), J. K. Conner (L. E. & W.), L. J. Hotchkiss, Richard L. Humphrey (Cons. Engr.), J. H. Prior, R. A. Rutledge (A. T. & S. F.), G. H. Scribner, Jr. (Contr. Engr.), Job Tuthill (K. C. T.), J. J. Yates (C. R. R. of N. J.).

The subjects assigned this committee were:

(1) Complete the report on principles of design of plain and reinforced retaining walls and abutments.

(2) Collect data concerning the cost and methods of constructing concrete piles, and make recommendation as to their use.

(3) Report on the cost, appearance and wearing qualities of various methods of surface finish for concrete.

(4) Joint committee on Standard Specifications for Cement.

(5) Joint committee on Concrete and Reinforced Concrete.

No report was made in the first item and the committee reported progress in items 2 and 3.

WOODEN BRIDGES AND TRESTLES

This committee consisted of: E. A. Frink (S. A. L.), chairman; W. H. Hoyt (D. M. & N.), vice-chairman; H. Austill, Jr. (M. & O.), J. E. Barrett (L. & H.), H. C. Brown, Jr. (I. C.), E. A. Hadley (M. P.), F. G. Hoskins (B. & O.), H. S. Jacoby (Cornell Univ.), A. O. Ridgway (D. & R. G.), I. L. Simmons (C. R. I. & P.), D. W. Smith (H. V.), W. F. Steffens (N. Y. C.).

The work that was assigned to this committee was:

(1) Continue study of relative economy of repairs and renewals of wooden bridges and trestles.

(2) Report on design of docks and wharves.

(3) Report on developments in practice of ballast deck trestles since previous report.

(4) Report on use of lag screws for fastening guard timbers.

The committee sent circular letters to various railroads regarding repairs to wooden bridges and decided that it is good practice to repair wooden bridges and trestles by parts until such time as the general condition of the structure requires entire renewal.

The committee ascertained that it was the general opinion of railway officials that the life of ballasted deck trestles would be 20 to 25 years and that the costs of these was 40 to 50 per cent of that of reinforced concrete. It was also ascertained that plans were being changed to use open stringer and floor-plank deck in place of the solid stringer deck.

The association adopted the first subject and will have it printed in the Manual. The work in the second subject was accepted as a progress report and ordered continued.

ELECTRICITY

This committee consisted of: George W. Kittredge (N. Y. C.), chairman; J. B. Austin, Jr. (L. I.), vice-chairman; D. J. Brumley (I. C.), R. D. Coombs (Cons. Engr.), A. O. Cunningham (Wabash), Walt Dennis (C. R. I. & P.), J. H. Davis (B. & O.), George Gibbs (Cons. Engr.), G. A. Harwood (N. Y. C.), E. B. Katte (N. Y. C.), C. E. Lindsay (N. Y. C.), W. S. Murray (Cons. Engr.), W. L. Morse (Jacksonville Terminal), J. A. Peabody (C. & N. W.), Frank Rhea (I. C. C.), J. W. Reid (C. & A.), A. F. Robinson (A. T. & S. F.), J. R. Savage (L. I.), A. G. Shaver, Martin Schreiber (P. S. R.), H. U. Wallace.

The work outlined for the committee was:

(1) Continue the study of the subject of clearances.

(2) Report on the effect of electrolytic action on metallic structures and the best means of preventing it.

(3) Continue the preparation of a standard specification for overhead transmission line crossings.

(4) Continue the study of electrolysis and insulation and its effect upon reinforced concrete structures.

(5) Report on maintenance organization with relation to track structures.

The report on clearances was adopted and the committee suggested that:

"The limiting clearance line for rolling equipment, as adopted by the American Railway Association, should be changed so that the points FE2½/15 and GE O/15 become FE 2½/6 and GE O/6."

This was adopted.

The committee submitted a diagram of clearances and made the following recommendations:

(1) The committee recommends for adoption by the Association and publication in the Manual Diagram "A," "Recommended Clearance Lines for Equipment and Permanent Way Structures Adjacent to Third Rail and for Third-Rail Structures."

(2) The adoption of the "Specification for Crossings of Wires and Cables of Telegraph, Telephone, Signal and Other Circuits of Similar Character Over Steam Railroad Rights-of-Way, Tracks, or Lines of Wires of the Same Classes."

(3) The adoption of the revised edition of the Specification for Overhead Crossings of Electric Light and Power Lines, with the understanding that the National Joint Committee will take up the question of the additions or changes in this specification previously suggested by this Association at its 1912 convention.

The committee recommends that representatives continue to serve on the National Joint Committee on Electrolysis and on the National Joint Committee on Overhead and Underground Line Construction.

It is also recommended that the statistical data furnished by the sub-committee on Clearance be added to from year to year and kept up to date, and that consideration be given any new information that may develop in reference to maintenance organization and relation to track structures, and asks for such other instructions as seem necessary or desirable.

The first recommendation was adopted, the second recommendation was approved, the third recommendation was approved and the others were referred to the Board of Direction.

YARDS AND TERMINALS

This committee consisted of: E. B. Temple, chairman (P. R. R.); B. H. Mann, vice-chairman (M. P.); W. G. Arn (I. C.), H. Baldwin (C. C. C. & St. L.), G. H. Burgess (D. & H.), A. E. Clift (I. C.), L. G. Curtis (B. & O.), H. T. Douglas, Jr. (C. & A.), A. C. Everham (K. C. T.), R. Ferriday (C. C. C. & St. L.), G. H. Herrold, D. B. Johnston (P. L. W.), H. A. Lane (B. & O.), L. J. McIntyre (H. P.), A. Montzheimer (E. J. & E.), H. J. Pfeifer (T. R. R. or St. L.), S. S. Roberts (Cons. Eng.), W. L. Seddon (S. A. L.), C. H. Spencer (I. C. C.), E. E. R. Tratman (Engineering News), E. P. Weatherly (K. C. T.), W. L. Webb (C. M. & St. P.), C. C. Wentworth (N. & W.), J. G. Wishart (C. R. I. & P.).

And the work assigned was:

(1) Report on typical situation plans of passenger stations, of both through and stub types, with critical analysis of working capacity, and include a review of the different methods of estimating their capacity.

(2) Report on developments in the handling of freight by mechanical means.

(3) Report on developments in the design and operation of hump yards.

(4) Continue study of track scales.

The committee made a careful study of the work at the new Kansas City terminal in connection with item No. 1 and described the methods used.

A favorable recommendation was made on the use of handling freight by power driven trucks in freight houses.

An elaborate table was presented showing comparisons of operation between the hump yard and two flat yards, but the committee was unable to show the cost of each item of expense on a car basis, but intends doing this next year.

The committee reported progress on the subject of track scales and that they had under consideration the report adopted by the American Railway Association in 1913. It was the desire of the committee, before making final recommendations on this subject, a very careful and full discussion shall be indulged in, and, with the approval of the Board of Direction, this committee will confer with the proper committee of the American Railway Association on an approved set of track scale specifications and rules.

The committee made the following suggestions for next year's work, viz:

(1) Continue study of typical situation plans of passenger stations and approaches and methods of operating same.

(2) Report on handling of freight in double-deck freight houses, with cost of operation.

(3) Continue study of classification yards:
- (a) Unit costs of operation of typical hump and flat yards.
- (b) Yard lighting.
- (c) Power vs. hand-operated switches in hump yards—advantages and disadvantages.

(4) Continue study, and, if possible, make report on track.

Annual Banquet of Engineering Association

Portions of Speeches Delivered at the 16th Annual Banquet of the American Railway Engineering Association

The sixteenth annual banquet of the American Railway Engineering Association was given in the Gold room of the Congress hotel March 17, 340 guests being present, who were entertained during the dinner by a musical program. President W. B. Storey acted as toastmaster and introduced the speakers. These were Chas. S. Gleed, president Missouri & Kansas Telephone Company; Sir George Foster, minister of trade and commerce in the cabinet of the Dominion of Canada; Frank L. Mulholland, president International Association of Rotary Clubs, and Benjamin Baum, chief engineer maintenance of way, Maumee Valley Railroad.

Mr. Gleed spoke "ABOUT THE HUMAN MIND," and said in part:

It is the habit of your lives to study foundations. In all the countless tasks that you undertake your first thought and your last relates to rocks, clays, soils, quicksands, water courses, pilings, fillings and footings—to whatsoever gives support to your structure. If you are neglectful of fundamental conditions in any respect it is probably, as with all high-class workers, within the realm of your own personal and professional welfare. That which means most to your personal and professional prosperity probably gets your last and your least attention. I cannot hope to tell you about this anything you do not already know. My only hope is that I may encourage you to give more attention than you hitherto have to a line of thought which I consider of paramount importance.

After taking every precaution which your own ingenuity can devise you are still at the mercy of those about you acting individually or in masses. It behooves you to know all you can of the weaknesses and treacheries of human nature.

In framing our opinions of the human mind as manifested by individuals or by masses, our obligation seems imperative to judge by the standards of the most exalted, the most powerful and most clear-visioned specimens of the race. Christ and Socrates, Paul and Plato, Shakespeare and Lincoln—such are the men by whose teachings we must judge ourselves and our fellows. If this be true, I think we are forced at once to the conclusion that the human mind is almost as far below the standards as it is possible to be and still remain in the class. In short, the human mind, as we have it to deal with practically, is a superlative failure—a failure which would be a joke were it not a tragedy.

As we consider the men with whom we are most familiar, it is at least disheartening to comprehend how soon the best of them arrive at the outer limits of their intelligence. Select the masters about you in all lines of activity and see how little they know of what is knowable. Experiment with the ablest of your acquaintances and see how little dependable for wisdom are the best of them outside the narrow limits of their own specialties. The more an individual knows about his own specialty the less he seems to know about the specialties of others—about things in general. The more he knows about some things the less he knows about all other things. This seems an unjust law, but it is the law nevertheless. Time is of the essence of achievement. To fully master one line of knowledge requires more time than any man ever yet had. How, then, can one be expected to know much outside of his own field—his own tiny garden of truth? The man who knows the stars may not know the flowers in his wife's conservatory. The man with the legal decisions at his tongue's end may not know first base from third. I knew a railroad president who solemnly assured me that any lameness could be cured, no matter what might be the cause or condition. I know a United States senator who is certain that he will never grow old, no matter how long he may live. I knew a college president who condemned railroad companies for issuing stocks and bonds because people were tempted to speculate in them. I asked him if he condemned farmers in the same way for raising grain and cotton. He said he had never heard of speculation in grain and cotton.

* * * *

I knew a railroad official who spoke of his subordinates as being fools or they would not be his subordinates. My thoughts ran along the same line, though his meaning and mine were different. I knew another railroad official who declared his subordinates to be "a bully lot of fellows." The first official had the big-head; the second had the greatest of all power in an official, the power to do justice without malice and without envy. Most of the men with the big-head have more or less real merit on which to predicate their intemperate self-appreciation. If there is a man in this room who has not at some time suffered irreparable injury because his superior was really his inferior through the working of this malady, then I miss my guess.

There is another mysterious mental disease, sometimes called the pig head. It is like the disease which afflicts the balky horse —and his driver. The big head is often cured but the pig head is hopeless. Annihilation or abandonment are the only remedies. The law against murder stops us on one side and fear of cowardice on the other. All we can do in the presence of a real case of pig head is to watch and pray.

* * * *

A mass of human minds in action never comes up to the level of the best in the mass or even to the level of the average. The process of compromising differences seems to result in the best making far more surrender than the worst.

This line of thought may seem, at first, pessimistic and ill balanced. On the contrary, it is intended to be optimistic and as good natured as a botanical analysis. It is a tearful yet entirely cheerful recognition of certain facts in the science of humanity and the history that man has made.

Sir George Foster spoke on the "MOBILIZATION OF HUMAN ENERGY."

We are living in a day when the community of workers is being constantly and aggressively forwarded. And so we are living in an age of association and conventions. If there is any one thing, looking at it from this point of view, which strikes one as differentiating this age from the ages long past it is that when we search through history we get very few records of associations and conventions of the workers and thinkers of the world. In this age we meet them every year and we look upon them almost every day.

All this means that we are making collections of knowledge in each one of the guilds and associations of workers and we are making it, not on the isolated plan, but on the plan of a community of interest. You work, each one of you in your own sphere and in your own locality, and then you come from every part of the United States and join in this great gathering every year and that knowledge that each one has gained and that experience which each one has had, and the results that he has worked out, are made common knowledge to you all and to the world as well.

It cannot be said that constructive engineering is the monopoly of any age or of any people. Go back as far as you please in history and there has been constructive work on more or less scientific principles, carried out by the engineer with skill and ability. You have beautiful palaces and temples; you have walled cities; you have works such as were developed in Egypt, the monoliths, the pyramids and the sphinxes; you have the splendid triumphs of Greece and of Rome in stone and marble, and there is hardly a country in the world where you cannot find the remains of great and wonderful engineering construction. There is just one characteristic which distinguishes between the constructive work of those ages and that of today, and that is that the work of those ages, it appears to me, had little respect for the utility, benefit and happiness of the masses. Those temples and palaces were built for the gods, for princes and for rulers. They lived in them during their lifetimes and they were buried in them after their deaths, or they were for the purposes of war, or they were for the commemoration of the wonderful things done by certain dynasties or commemoration of some great historical event, wrought out in those symbolical figures and signs that we find still remaining extant.

* * * *

Neither do I think that railroad engineers, making a guild of themselves, bringing from all parts of the world their experiences, their results and their knowledge, and making it common and correlating it with that of all others, should stop there, because the railroad engineers, as a guild, are only a part of the working guilds of the world and the other guilds in other lines must see with long, steady vision what all these are tending to, the uplift of humanity in the common work of the units and the associations of workers the wide world through.

So, I think the association of workers do their best when they correlate their work with the great purpose of all work. The works of today look toward the utility and the happiness and the comfort of the masses of people. Take those great works of irrigation which today in India are being carried out by the British government; take the works of irrigation in Egypt which add vast spaces of territory, convert them from the desert to fertility and give opportunity for work to those who work them and opportunity for supply to those who need the supply. How different are those in their scope and their virtue from those great constructive works of the ancients that have no utility in them and confer no benefit upon the great masses of mankind.

We are more than carpenters and bridge builders; we are more than blacksmiths and machine builders; we are men. We are builders of character, builders of homes, builders of states, builders of nations, builders of empires; and when we rise to that thought and keep it with us, the smaller planes of work are ennobled and our own spirit grows and our vision is made stronger and better as we show ourselves and feel ourselves niched in with every other man the wide world through, for the betterment of the race and the happiness of mankind.

Frank L. Mulholland spoke of "BE GOOD FOR SOMETHING," in part:

Do you know that every line of human activity is looking for the fellow who is good for something? In politics, in religion, in society, in business, in commerce; here and there and everywhere the cry goes out for more men who are good for something. Our fellow men do not care very much about what we have. But they are intensely interested in the question of what are we doing with it and how did we get it? Someone has said there is a readaptation of an old phrase, "The survival value"; not the survival value of those things we commonly call property, but the survival value of life, your survival value, my survival value. The worth of the individual today is measured by the question of whether somewhere, somehow, he has fathered some great thought, put into operation some splendid enterprise, stood for something for the common good that lives when he is gone.

I don't think that any man can be good for anything unless he has learned to smile. I have a wholesome respect for the influence of a smile. I used to live in a town in Michigan called Ausable. A fire visited that town a few years ago and burned up everything that could be burned. So we called together a lot of the old crowd and proceeded to bury the town. About two years after that I thought I would stop off and see the old locality. I found to my surprise a station there, a bus running up town, a hotel, about 150 houses, a bridge across the Ausable river, and a new dock sticking out into Lake Erie. That night I picked up their little paper and I saw a prominent exhibit of what I thought must have been the slogan that was adopted by the men who rebuilt my old town, and here is what it said: "Smile, you son-of-a-gun, smile!"

I don't think a man can be good for anything or develop a survival value unless he is a booster. Somehow I don't believe that a man can be good for anything who is a knocker. I distinguish between a knocker and a kicker. It may be necessary to kick, but a knocker is a fellow who is born that way and who can't help it, and the only thing that you can do with that kind of an individual is to give him a hammer, turn him into a blacksmith's shop and let him work at his natural calling.

If you and I, and each of us, would just lay hold of a little sunshine, just get a good grip on optimism, see that our fellow men are worth while, this old world is a good place in which to dwell, we would make our respective communities a good place in which to live. The doctrine that the badge of service becomes the diadem of sovereignty is the truest gospel that can be preached in my sermon, and it is a wonderful little doctrine. With optimism in our hearts, with the desire day after day to do something for the other fellow, we cast our bread upon the waters and it will come to us another day.

Railway Engineering Association Officers

Names and Titles of Officers Elected at the Convention for the Year 1915-16

The result of the election of officers of the American Railway Engineering Association for the coming year was as follows: President, Robert Trimble, chief engineer maintenance of way, Northwest System, Pennsylvania Lines West, Pittsburgh, Pa.; first vice-president, A. S. Baldwin, chief engineer, Illinois Central, Chicago; second vice-president, John G. Sullivan, chief engineer, Western Lines, Canadian Pacific, Winnipeg; treasurer, George H. Bremner, assistant district engineer, division of valuation, Interstate Commerce Commission, Chicago; secretary, E. H. Fritch, Chicago; directors for three years, H. R. Safford, chief engineer, Grand Trunk, Montreal, Que.; C. F. W. Felt, chief engineer, Santa Fe System, Chicago, and A. N. Talbot, professor, municipal and sanitary engineering, University of Illinois, Urbana, Ill. Members of the nominating committee: Paul Didier, principal assistant engineer, Baltimore & Ohio, Pittsburgh, Pa.; Hadley Baldwin, assistant chief engineer, Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati, O.; C. E. Smith, assistant chief engineer, Missouri Pacific, St. Louis, Mo.; F. E. Turnaure, dean, college of engineering, University of Wisconsin, Madison, Wis., and D. J. Brumley, valuation engineer, Illinois Central, Chicago.

Robert Trimble, President, Chief Engineer Maintenance of Way, N. W. System, Penn. Lines.

A. S. Baldwin, 1st Vice President, Chief Engineer, Illinois Central.

John G. Sullivan, 2d Vice President, Chief Engineer, Western Lines, Canadian Pacific.

E. H. Fritch, Secretary.

Standardization of Culverts

For bridges over large streams or in locations where many peculiar conditions must be satisfied, complete standardization of designs is impossible. For small and minor crossings, cattle passes and narrow subways, such standardization is possible and leads to great economy in design and construction.

A few years ago standard concrete culverts were unthought of, except on a few roads which even at the present time are far ahead of their contemporaries in concrete design. In those times a special study and design was made for each particular case and as a result the engineering and construction costs were high.

As the industry progressed engineers found that standardizing concrete structures resulted in bridges of a more uniform strength, better appearance, and all this at less cost as a result. All the larger roads have standard designs for culverts, subways, retaining walls, piers, abutments, etc., covering the range of conditions to be met on their lines.

Among the most complete and very latest of these standards are those of the St. Louis & San Francisco R. R. for reinforced concrete box culverts and plain concrete arch culverts covering about eighty different structures, published on another page. We feel especially fortunate in being able to give our readers these standards since they should prove of great value to the designing engineer.

Where railroads do their own construction work standard designs are especially desirable, since the construction gangs very soon become accustomed to the various details of construction which are typical for all structures of a class and efficiency in construction is the outcome.

TEMPERATURE STRESSES IN ARCHES

The following paragraphs, abstracted from a paper by C. B. McCullough, designing engineer, Iowa Highway Commission, before the American Concrete Institute on the "Design of Concrete Bridges with Special Reference to Standardization," are of interest in that they treat of the effects of temperature stresses in arches and methods of providing for same.

The stresses arising in the ring of an arch are statically indeterminate and * * * therefore are dependent not only upon the loadings but also upon the size and shape of the arch ring as well.

The recent data on temperature variation have operated to modify to a considerable degree the limitations of the design and the economical section of the arch type, and much of the data published is now of little value, especially for the lighter highway loadings. This is shown by a consideration of the following facts:

In the design of concrete arches, it has been customary among many designers and engineers to allow an arbitrary percentage of from 10 per cent to 20 per cent of the dead load and the live load stresses to cover stresses induced by temperature change. All stress values then become a function of the external loading and the following relationships can be easily shown to exist:

1. For a given span the moments are independent of the rise but the thrusts vary inversely as the rise.

2. The fiber stress being largely determined by the bending moment rather than the thrust does not increase rapidly with a decrease in rise and analyses of very flat arches often fail to indicate serious overstress.

3. The unit fiber stresses vary approximately as the bending moment and inversely as the square of the depth of section. Thus a condition of overstress can be remedied by simply increasing the section, as the moments and thrusts remain practically unchanged.

The tests conducted on arch bridges in Iowa (Railway Engineering, Sept., 1913, page 433) disclose a temperature condition far in excess of that formerly believed to exist and the resulting moments are found to be nearer 100 per cent than 10 per cent of the dead and live load values, as is illustrated by a comparison of five typical arch spans given in Table 1.

TABLE I—COMPARATIVE BENDING MOMENTS DUE TO D. L. AND L. L. AND TO TEMPERATURE VARIATION.

Arch Ring	Span Ft.	Bending Moment Ft. Lbs. D. & L. Load	Bending Moment Ft. Lbs. Temperature	Live Loadings.
A	40	8,466	30,302	100 lbs. per sq. ft.
B	55	34,050	43,800	200 lbs. per sq. ft.
C	60	30,791	38,310	60 ton elec. eng.
D	70	48,676	45,700	40 ton elec. eng.
*E	90	23,350	31,580	100 lbs. per sq. ft.
F	70	71,724	50,300	60 ton elec. eng.

*Light open spandrel construction.

In view of the fact that the temperature variation, particularly for light highway loadings, becomes the determining factor, the following relationships which can easily be proven seem to have an important bearing on the limitation of the design:

1. For a given span the moment due to temperature varies inversely as the rise and the corresponding thrust varies inversely as the second power of the same. Thus a slight decrease in rise will produce a material increase in ring stress.

2. While the fiber stresses for a given moment vary inversely as the square of the depth of section it must be remembered that in dealing with temperature changes the moments themselves vary directly as the cube of the depth of section. Thus when the temperature moment constitutes the largest part of the total moment an increase in section oft-times operates to increase rather than decrease the unit fiber stresses.

3. The stresses due to temperature are maximum at the crown and spring line of the arch but of opposite sign. These decrease from crown to spring line passing through a zero value and assume their original or crown values at a point near the quarter (this point can be determined exactly for every arch, it being dependent upon the shape and size of the arch ring.)

From the first two considerations it is at once apparent that for each span length there will be a limiting minimum rise beyond which it is not safe to design. From the third consideration it is apparent that for light highway loadings in which temperature stresses are largely governing there need be in general but slight increase in section between the crown and the quarter point.

Very few arches are economically designed, and the great need of experimentation along this line is apparent to all who are familiar with the problems presenting themselves to the designer.

Concrete Station—S. P. L. A. & S. L.

The San Pedro, Los Angeles & Salt Lake R. R. will construct a new station 162x110 ft. at Los Angeles, Cal. The station which will combine all the latest modern features is to be erected on the south side of Seventh St. and the east bank of the Los Angeles river. The building will be two stories in height, of the classical style of architecture with mission features. It will be constructed of reinforced concrete finished with glazed terra cotta and red tile roof.

Senate to Investigate Arch Patents

The resolution submitted by Senator Bristow authorizing the committee on patents to investigate the issuing of patents to Daniel B. Luten passed the United States Senate on March 1. The committee is given full power to summon witnesses and administer oaths for securing evidence and is directed to report the result at as early a date as practicable.

NEW BOOKS

CONCRETE STONE MANUFACTURE. By Harvey Whipple, Managing Editor *Concrete-Cement Age*. Leather, 4¾x7 in.; 255 pages, 126 illustrations. Published by Concrete-Cement Age, Detroit, Mich. Price, $1.00.

This, the only real handbook of the concrete stone industry, is in reality a report of the progress which has been made in spite of the purely commercial and unscrupulous spirit which at one time pervaded the field. As the author states in the first chapter, the block industry is much older than the automobile or reinforced concrete industry, yet it has by no means grown apace, since it has not, until recently, received the attention of trained men. It has been handicapped by the apparent simplicity of the operations and problems involved. The machinery manufacturers are somewhat to be blamed for this state of affairs because of the highly "colored" advertisements used by some, picturing the "easy money" and success to be attained for a small outlay by anyone who had an empty woodshed or basement with a gravel bank handy. With men who bought block machines with this misguided idea in mind the use of enough cement was too expensive a proceeding and as a result the country was for a time deluged with pressed sand blocks more serviceable for filters than for building material.

Some of the railroads have realized the economy and possibilities of concrete stone in depot and station construction for walls, and exterior and interior trim, and have thereby opened up a field for concrete stone which is practically unlimited.

The book consists of ten chapters treating of the development of concrete building units; location, equipment and plant layout; materials, mixtures, manipulation; curing; special molds and patterns; surfaces, shop records and cost keeping; building regulations, tests and specifications; selling the products; and examples of layouts and operation.

The book is well arranged and illustrated containing much information on practical subjects gleaned from the best authorities in the field. It contains a wealth of good material and should be in the hands of every manufacturer of such products, the architect and the structural engineer.

PLAIN AND REINFORCED CONCRETE ARCHES. By J. Melan; authorized translation by D. B. Steinman. Cloth, 6x9 inches; 161 pages; 43 figures. Published by John Wiley & Sons, New York. Price, $2.00.

Professor J. Melan is recognized as one of the leaders in the field of structural design and this translation of his article on arches in the *Handbuch für Eisenbetonbau* (Handbook of Reinforced Concrete Construction) is recognized as one of the most thorough treatments of the subject of reinforced concrete arches in any language.

Prof. Steinman has therefore made a very valuable addition to technical literature by this translation, and is deserving of much credit for the admirable manner in which he has carried out this difficult task. Unlike most translations all numerical examples and data have been converted from metric to English units; which is really a necessity to make the examples do the work intended for them.

The first two chapters treat of the fundamental principles of arches and the stresses in reinforced concrete sections. Chapters 8, 9 and 10 are on arches with elastic abutments, and arches continuous over several spans and discuss these features regarding which we see little or nothing in our American books and they are therefore of exceptional value. Chapters 11 and 12 on determining the best curve for any arch and the thickness for any arch present some easily applied formulae for determining these factors as the preliminary to the actual design, illustrated with numerical examples. An explanation of the use of a chart is shown for use in proportioning or investigating concrete sections with single or double reinforcement. An appendix giving complete computations of stresses, analytic and graphic respectively, for two notable European reinforced concrete arches follows. A little over a page of references to European and American works on the subject are given.

The book will no doubt become the prime reference work on the subject, for the bridge and structural engineer and it will no doubt become as popular here as it has abroad.

Current Prices—Concrete Materials

Portland Cement—The prices quoted on cement in the East and North Central states for April are somewhat lower than those for last month. In the South and west of the Mississippi river the prices are unchanged and the demand is about the same. Prices given f. o. b. cars at points named, including cloth sacks, for which, in general, 40c per barrel (4 sacks) is refunded on return in good condition. Prices per barrel (including 4 cloth sacks) are as follows: Boston, $1.46; New York, $1.22; Chicago, $1.55; Pittsburgh, $1.45; New Orleans, $1.64 on dock; Memphis, $1.64; Cleveland, $1.54; Detroit, $1.54; Indianapolis, $1.58; Peoria, $1.54; Cincinnati, $1.58; Columbus, $1.62; Toledo, $1.58; St. Louis, $1.45; Milwaukee, $1.55; Minneapolis and St. Paul, $1.65; Kansas City, $1.43; Omaha, $1.43; Spokane, $1.75; Seattle, $2.30; Tacoma, $2.30; Portland, Ore., $2.30; Duluth, $1.77.

Crushed Stone—1½-inch stone, prices per cubic yard, f. o. b. cars in carload lots, unless otherwise specified. Boston, 80c per ton at the quarry; New York, 80 to 85c, in full cargo lots at the docks; Chicago, $1.05; Spokane, $1.00; Portland, Ore., $1.15; Seattle, $1.50.

Gravel—Prices given are per cubic yard f. o. b. cars in carload lots unless otherwise noted. Boston, 75c; New York, 90c in full cargo lots at docks; Chicago, $1.05; Spokane, $1.00; Portland, Ore., 85c; Seattle, 75c; Tacoma, 75c.

Sand—Prices are per cubic yard f. o. b. cars in carload lots unless otherwise indicated. New York, 50c, full cargo lots at docks; Chicago, $1.05; Spokane, 75c; Seattle, 75c; Portland, Ore., 85c; Tacoma, 75c.

Reinforcing Bars—Although the demand for bars has not increased materially, the steel manufacturers have determined to secure better prices and as a result April deliveries will be made on a basis of $1.20 per cwt., Pittsburgh, with prevailing extras for bars under ¾-inch or base. The following are quotations on base bars per 100 lbs. for mill shipments from other points, f. o. b. cars: New York, $1.36; Philadelphia, $1.35; Chicago, $1.38; Spokane, $2.20; Seattle, $1.85; Portland, Ore., $1.90; Tacoma, $1.85.

Shipments from stock are being made at the following prices per cwt. f. o. b. cars; Pittsburgh, $1.65; New York, $1.95; Cleveland, $1.80; St. Louis, $1.90; Chicago, $1.85; Spokane, $2.50; Tacoma, $2.20; Portland, Ore., $2.15; Seattle, 2.20.

Metal Clips for Supporting Bars—$4.50 to $6.50 per 1,000, depending on size.

For the majority of the prices given we are indebted to the Universal Portland Cement Co., Sandusky Portland Cement Co., Concrete Steel Co., American Sand & Gravel Co., Chicago, and F. T. Crowe & Co., Seattle, Portland, Spokane and Tacoma.

Reinforcing bars for mill shipments are in general sold on a Pittsburgh basis; this is, at the Pittsburgh quotations plus the freight to the point in question, and with the following list of freight rates on finished material and the Pittsburgh quotations given, the prices of bars at any of the points listed can be readily computed.

From Pittsburgh, carloads, per 100 pounds to:

Albany	16 cents	Columbus	12 cents
New York	16 cents	Cincinnati	15 cents
Philadelphia	15 cents	Louisville	18 cents
Baltimore	14½ cents	Chicago	18 cents
Boston	18 cents	Richmond	20 cents
Buffalo	11 cents	Denver	85 cents
Norfolk	20 cents	St. Louis	23 cents
Cleveland	10 cents	New Orleans	30 cents
Minneapolis	32 cents	Indianapolis	17 cents
Kansas City	42½ cents	Omaha	42½ cents
Birmingham	45 cents	Rochester	11½ cents

Structural Steel and Concrete Slab Bridge

A Seven Span Slab Structure of "I" Beams Encased in Concrete, at Mortonville, Penn., Philadelphia & Reading

BY ALBERT M. WOLF, C. E.

In connection with its extensive improvement work inaugurated some time ago, the Philadelphia and Reading Ry. has recently (November, 1914) completed a seven-span single track, steel and concrete slab structure over Brandywine Creek, south of Mortonville, Pa., on the W. & C. Division (Figure 1). This type of structure is used considerably by this road for low crossings and another structure of the same type, but longer spans is now under construction at Albany, Pa.

Fig. 1. Bridge Over Brandywine Creek, Mortonville, Pa., P. & R. Ry.

GENERAL DESIGN

The new bridge replaces a wooden pile trestle which by changing the alignment over the new bridge was used for traffic during construction. The structure has a length of 124 ft. 4 in. between faces of abutments, made up of seven spans 15 ft. in the clear, resting on piers set at a skew of 81 deg. 30 min. with center line of track. The width of bridge is 17 ft. 9 in. under coping, with provision for future extension on one side to make a double track structure. The extra width of present structure is necessitated by the bridge being located on a 5 degree curve.

The base of rail is located 9 ft. above high water level, while the piers are about 12 ft. high above top of footings.

DETAILS OF DESIGN

Piers and Abutments—The piers and abutments are of plain concrete of a 1:3:6 mixture, resting in the majority of cases on loose rock, while one pier is founded on clay and the other on gravel, a few feet below bed of stream. The piers are 3 ft. thick, with vertical faces, and 45-degree cut-waters, and rest on footings 5 ft. wide. The abutments are of the gravity type with wings splayed at 45 degrees at the upstream end; the downstream wings to be built when the bridge is extended for second track. In order to connect the two portions keyways were left in ends of piers and abutments to key the extension to the present work, as shown in Fig. 2, the detail plans.

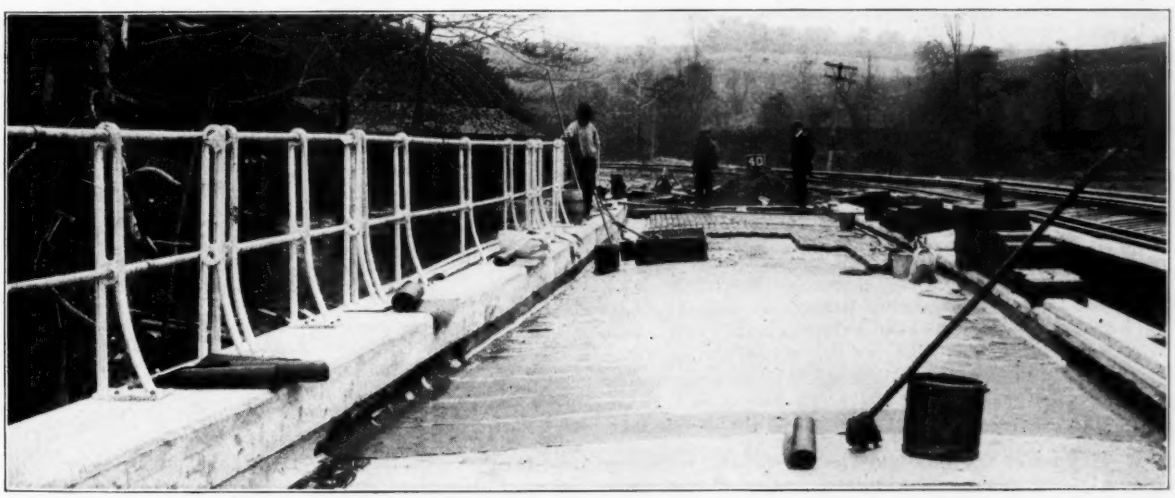


Fig. 3. Waterproofing the Deck, Mortonville Bridge, P. & R. Ry.

Deck—The deck consists of 18-in. I-beams spaced 1 ft.

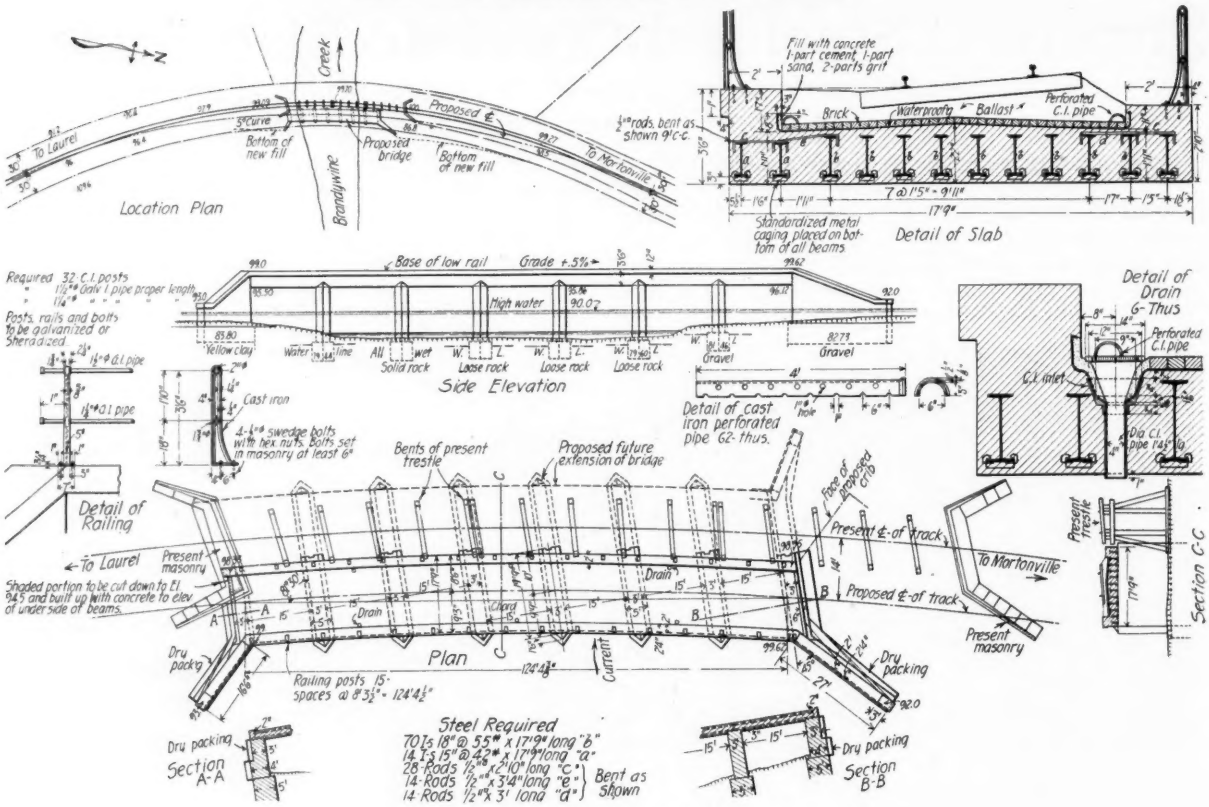


Fig. 2. Details of Mortonville Bridge, P. & R. Ry.

5 in. centers except under east parapet, where two 15-in. I-beams are used at greater spacing. A standard metal caging was placed on the bottom of all beams and they were then encased in concrete with a 3-in. protection for bottoms of I-beams, the slab being 26 in. thick at center and 23 in. at the sides to provide drainage slope. The tops of the three outer I-beams on each side were tied together with ½ in. sq. hook bars. Otherwise no additional reinforcement was used. (See Fig. 2.)

The east parapet is 1 ft. 7 in. high and 2 ft. wide on top, the coping projecting 4 in. beyond face of slab. The west coping, on the side designed for future extension, is built 11 in. above slab and 2 ft. wide without projecting coping. These copings are surmounted by galvanized iron pipe railings carried on braced cast iron posts. (See Fig. 2.) In the slab and parapets, concrete of a 1:2:4 mixture was used.

WATERPROOFING

The deck is waterproofed with Hydrex felt laid with wide laps and covered with asphalt, with vitrified brick as a protection, the felt being flashed up into a pocket 8 in. high and 3 in. deep in the parapets and covered with 1:1:2 concrete. Figure 3 shows the waterproofing being put on and the protecting layer of bricks being laid at the far, or south end.

DRAINAGE

To carry away the seepage water 6-in. cast iron pipe cut in half and perforated with four lines of 1-in. holes was laid next to parapet. (See Fig. 2.) At the middle of each alternate span were placed cast iron down-spouts covered with gratings. After the drain pipes were laid the rock ballast was hauled in and the track laid.

Surface Finish—All edges except the underside of coping were rounded off. The faces of piers and abutments were scored and all showing faces have a granolithic finish produced by depositing with the concrete a front surface at least one inch thick composed of one part cement, two parts sand and two parts granite or trap rock grit. The face forms were removed as soon as the concrete had sufficiently set and the faces bush-hammered until the grit was exposed, making a uniform surface.

DESIGNING LOADS

The bridge was designed for Cooper's E-55 loading with impact allowance in accordance with the formula $I = S\frac{L+300}{300}$, where I = impact to be added to live load stress, S = live load stress and L = loaded length in feet, which produced maximum impact. The I-beams were designed to take all the stresses due to dead, live and impact loads, the concrete acting only as a protection to the beams.

COMMENT

The writer is indebted to Mr. Wm. Hunter, Chief Engineer, P. & R. Ry., for plans, photographs and data used in this article.

Antiquity of Concrete

In no period was concrete used to any extent without facing except in foundations and other visible parts of buildings. Roughly at the beginning of the Christian era it reached the position of dominant material (or mode) of construction. Before 100 B. C. some monumental structures containing concrete were erected and from that time on the material was increasingly used, including exterior facings in concrete. The dome of the Pantheon, erected 123 A. D., is still regarded as the finest example of ancient concrete work extant. It is 142 ft. in diameter, with an opening of 30 ft. diameter at the top, and without showing appreciable injury has withstood the destructive influences of the weather for nearly 2,000 years.—*American Journal of Archaeology.*

The Signal Department

Fundamental Characteristics of Signal Lenses

Lenses of Different Types, with Data of Candle Power in Axis, and Spread for Each, as Prepared and Copyrighted by the Adams & Westlake Company

The primary purpose of a signal lens is to control the distribution of the light of the burner, and this is accomplished without increasing or appreciably diminishing the volume of light at the source. The light from a naked lamp diverges so that only a small portion of the light falls upon the eye of the observer. The effect of the lens is to concentrate the rays of light which are refracted through it, and this process may be carried to the point where all the light falling upon the lens may be so focused as to fall upon one spot; but in practical signal service such an extreme result is not desired, since the indications should be visible from more than one position in the general direction of the track.

On tangent track, where the engineer's movement is practically in a constant direction with respect to the signal, it is possible to concentrate the light in a narrow beam and make it visible over a long distance. Should it be desirable not to diminish the spread of the beam horizontally, as in Fresnels for marine service, all that can be done is to converge the light toward the horizontal plane. Obviously the wider the area over which the light is distributed, the shorter will be the distance at which the signal can be seen. For comparison, a 5⅜-inch standard optical lens gives 69 beam candle power, while an 8-inch Fresnel, with the same source of light, gives only 9.1 beam candle power, or less than one-seventh as much.

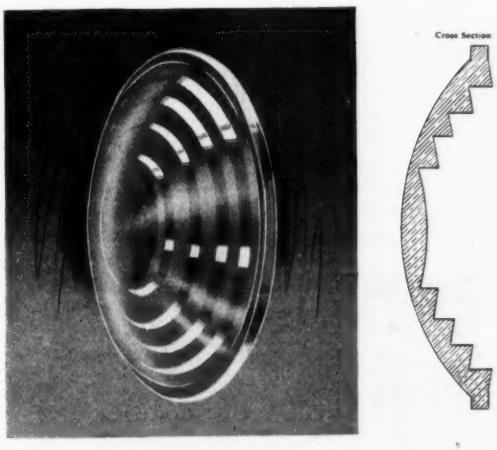


Fig. 1. Standard Optical Semaphore Lens.

It should be borne in mind that with the same flame and lenses of the same design and focal length, the beam candle power of the signal increases or diminishes in proportion to the square of the diameter of the lens,—in other words, in proportion to the area. Thus the advantage of using a large lens is apparent. For example, by increasing from a 5-inch to a 5⅜-inch lens, the candle power is raised from 57 to 69, or twenty per cent, and the effectiveness of the signal is increased proportionately. Further, the spread will increase as the dimensions of the source of light increase, and as the focal length decreases.

Atmosphere conditions largely determine the distance at which any signal is effective. Under like conditions, the range of visibility varies in proportion to the square root of the candle power of the beam.

Below are data of the sizes, foci, candle power, and spread in feet per hundred with one-day and long-time burners, and the various types of signal lenses now in use. In securing the figures, the flame of the one-day burner was adjusted to give 3 candle power, and that of the long-time burner to give 1 candle power. The spread was measured at right angles to the axis of the beam at 100 feet, and the figure given is the maximum spread in feet at that distance. The same ratio is maintained at all distances,—that is, a spread of 15 feet at 100 feet in distance indicates a spread of 150 feet at a distance of 1,000 feet from the lamp.

In obtaining these figures, the flame was set at right angles to the axis of the lens. About 25 per cent more candle power can be obtained along the axis by setting the flame at a 45-degree angle to the lens axis—as is the practice in four-way switch lamps—but there is a corresponding loss in spread.

It will be seen that with most lenses the long-time burner gives a beam of greater candle power than the one-day. This is due to the greater intrinsic brilliancy of the long-time burner flame because of more perfect combustion.

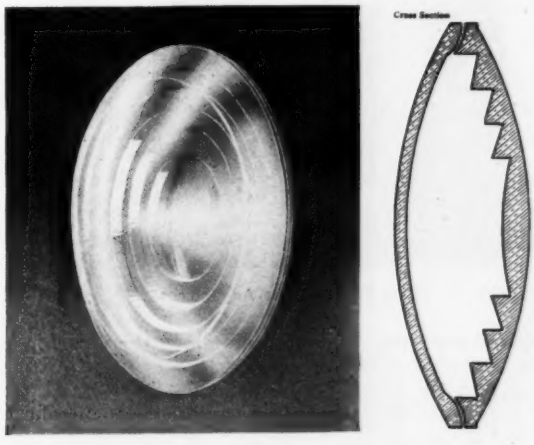


Fig. 2. Inverted Lens With Cover Glass.

The standard optical semaphore lens (Fig. 1) has been in universal use since 1905 in practically all types of railroad signal lamps. It is so designed that the greatest possible amount of light falling upon its surface is utilized, and it directs this light in a concentrated beam so that the signal can be seen for a maximum distance. These lenses have sufficient spread to insure the signal being picked up at long range, provided the lamps are not set at points where the track curves sharply. The data of candle power and spread for one-day and long-time burners, with a 5⅜-inch lens, 3½-inch focus, are as follows:

Burner	Candle Power Along Axis.	Spread in Feet per 100.
One-day (2 c. p.).....	56.2	22.6
Long-time (1 c. p.)...	69	14

The inverted lens (Fig. 2) with cover glass was designed to meet the demand for a lens with greater spread and approximately the same range as the optical type. This lens without the cover glass has practically the same candle power as the optical lens, and with the cover glass it has within 10 per cent of the candle power of the optical lens, at the same time giving an increase in extreme spread of approximately 35 per cent. When used with a cover glass it presents two smooth and easily cleaned surfaces. The inverted lens is being adopted for use in many signal lamps where special conditions make increased spread advantageous. The candle power along the axis of a 5⅜-inch lens, with 3½-inch focus, is 55.3 for the one-day burner and 66.8 for the long-time burner. The spread is 30.3 and 16.75 respectively, for the two kinds of burners.

The wide-angle lens (Fig. 3), although similar to the optical lens in general appearance, is designed to spread the beam over a wider area, so that by placing the lens in the standard lamp the signal will be visible through a wider angle, but with reduced intensity and range. It is well adapted to switch lamps in a yard where high intensity of light is not required, but where a rather wide spread is desirable. Wide-angle lenses are not recommended for long-range service. Based on the use of a

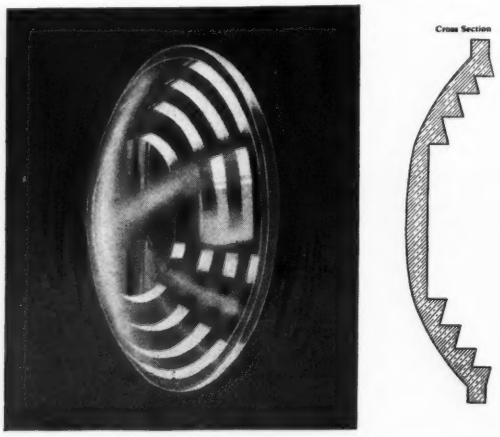


Fig. 3. Wide-Angle Lens.

5⅜-inch lens, the candle powers along the axis for one-day and long-time burners, respectively, are 16.6 and 11½, and the spread in the two cases is 44½ and 34.

"Spreadlite" lenses (Fig. 4) are the latest modification of the series of round lenses. They afford a compromise between the high candle power of the optical and inverted lenses and the relatively diminished candle power of the wide-angle lens. Convex panels on the convex face produce an elongated spread of nearly 35 degrees—in other words, sufficient to cover a 3-degree curve at 2,500 feet. These lenses have been designed in "smooth face" and inverted types, and have more than double the intensity on the axis possible with a Fresnel lens. The visible illuminated area of this lens being far greater than that of the Fresnel produces a very effective signal, and is equally satisfactory with long-time and one-day burners. A further advantage in the use of these lenses lies in the fact that they do not require special lamp bodies, and can be substituted for lenses of the same size in existing service where a wider spread is considered advantageous.

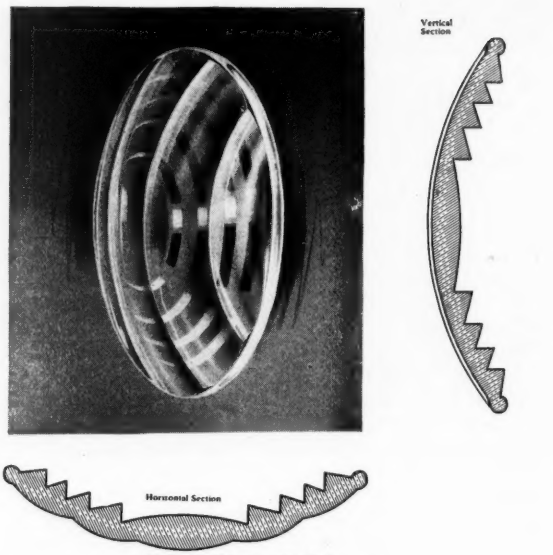


Fig. 4. "Spreadlite" Lens.

The data for the "smooth face" type, with one-day and long-time burners, respectively, are: candle powers along the axis, 33.3 and 27; spread, 60 and 65. The corresponding data for the inverted type are: candle powers, 40.2 and 32.7; spread, 63.2 and 61.6. The size of lens in each case is 5⅜ inches.

There has been discussion as to the advisability of equipping some lamps with lenses of still wider spread. Experience has shown that the inverted and spreadlite lenses, previously described, fulfill all requirements. The wide-angle lens is also useful under certain conditions. All these lenses have the marked advantage that they fit the present standard lamps.

To meet special cases where a wide spread of relatively high intensity is required, a special type of Fresnel known as the "duplex" lens (Fig. 5) has been designed. This lens is, for its size, the most powerful type of Fresnel which has ever been produced. By means of suitable prismatic corrugations it confines the light received on 70 degrees of its cylindrical surface to a spread of approximately 35 degrees, thereby affording double the intensity of illumination possible with a Fresnel of similar dimensions. The "duplex" lens pre-

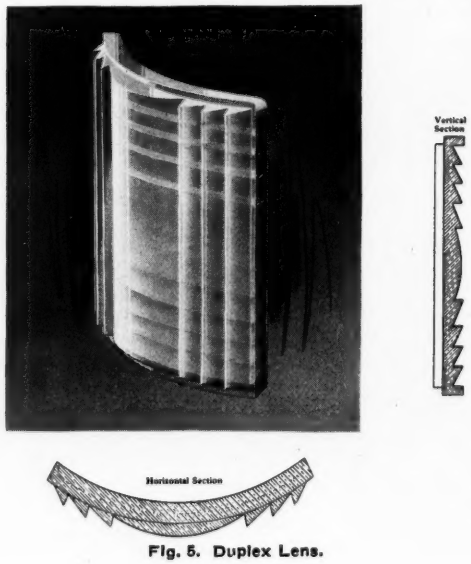


Fig. 5. Duplex Lens.

Fig. 6. 120° Compound Fresnel Lens.

vents any possible confusion of signals, such as is likely to occur where Fresnels having an excessive spread of beam are used in lamps which are inaccurately aligned. The utmost care must necessarily be exercised with wide-spreading Fresnels to prevent false indications, especially on curves. Too much spread is worse than too little. Based on the use of a 5-inch lens, the candle powers along the axis for one-day and long-time burners, respectively, are: 27½ and 13.7. The corresponding data for spread are 61 and 52.

The design of the 120-degree compound Fresnel lens (Fig. 6) presents a novel type of sectional Fresnel, and was primarily made for use in classification signal lamps to meet the suggestion that an observer might pick up classification signals more readily if there were several beams of light in place of only two, as on the standard classification lamp. Of necessity the beams of this new lens are weaker than those of the standard optical semaphore lens, but four separate beams are projected. One beam is parallel to the track, one is at a right angle to the track, while the other two are spread intermediately between. This Fresnel has a smooth outer surface, and consequently has no ledges to collect dirt, snow or sleet. The candle power along each axis for one-day burner is 22½ and the spread 45½.

The smooth-face Fresnel lens (Fig. 7) was introduced in 1906 for use in a rear-end platform lamp to secure a maximum spread. By having the corrugations on the inside and a smooth surface on the outside, no snow or dirt can collect upon the outer surface. Due to its short range of visibility, it is not recommended except with a high-candle-power burner. In combination with a powerful 10-c. p. burner, it has produced excellent results. It may be used to supplement the standard tail or marker lamps with their penetrating signals, if extremely sharp curves are to be considered. At present it is made in two sizes—45 and 90 degrees, 7 inches high, on which basis the candle powers for one-day and long-time burners, respectively, are 12½ and 10.2; and the spread in each case is 200.

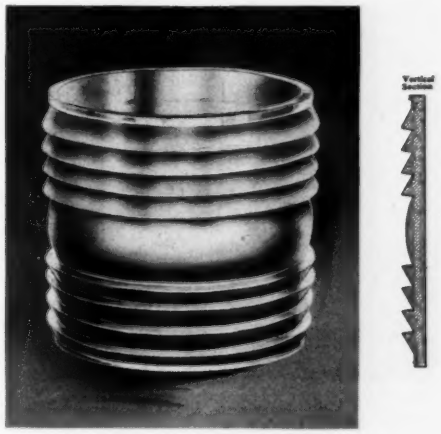


Fig. 8. Fresnel Lens.

Fresnel lenses (Fig. 8) are seldom used in railway service, except as required in lamps on bridges over navigable rivers. Eight inches is the standard height, as called for by the United States Lighthouse Commission. All such lenses are furnished in exact conformity with their requirements. The candle power for the one-day burner is 11½ and for the long-time burner 9.1. It can, obviously, be seen through a horizontal angle as wide as that subtended by the lens.

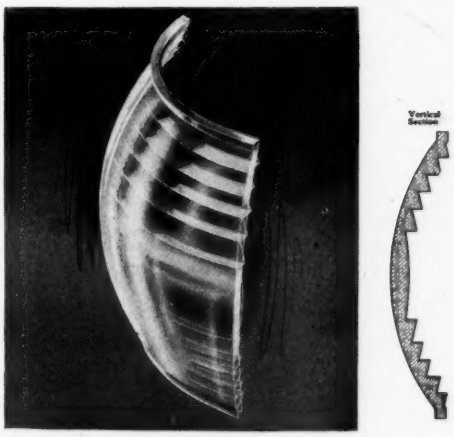


Fig. 7. Smooth-Face Fresnel Lens.

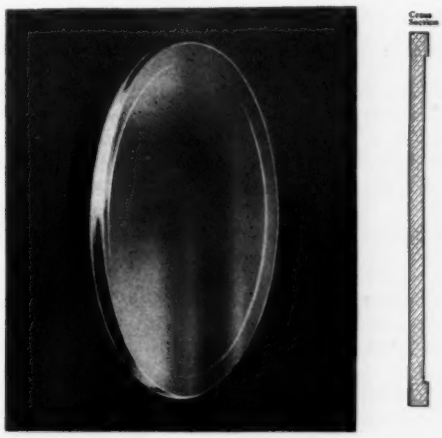


Fig. 9. Roundel.

Roundels (Fig. 9), which are not lenses, are discs of the same color and glass as the standard lens, insuring a conformity of colors in all signals. Since they are molded, they are structurally very strong. They can be furnished in all standard colors and sizes called for in present-day signal practice. At the present time, all colors for lenses as well as roundels are being furnished according to the Railway Signal Association specifications. Further developments are in progress, which will shortly insure still greater efficiency. During this development the necessity for distinct color with maximum intensity has been kept in mind at all times, and in consequence the new glasses are called "high transmission" colors.

The use of a reflector with a lens imposes special requirements. It is necessary to redirect the light falling upon the reflector in such a way that it passes back through the source and the lens. This the prism glass reflector (Fig. 10) does in a most efficient manner.

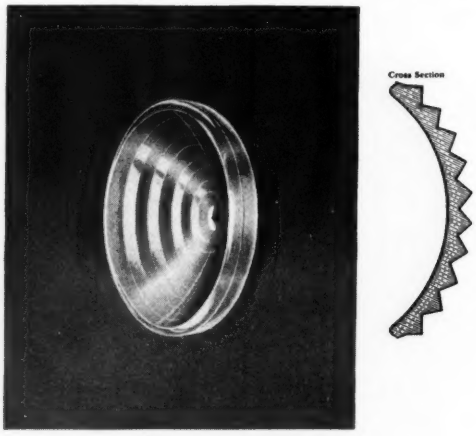


Fig. 10. Prism Glass Reflector.

The increase in signal efficiency effected by the use of the prism glass reflector varies with the size and focus of the lens and reflector. By reflecting through the lens some of the light given off by the burner which would not otherwise fall on the lens, the prism glass reflector usually increases the signal efficiency 15 to 20 per cent. The size commonly used in railway semaphore lamps is 3⅜-inch diameter and 1¼-inch focus.

The prism glass reflector has a further advantage over metal reflectors in that it will not tarnish and lose its reflecting properties. Should it become soiled, it can always be restored to its initial efficiency by washing.

Typographical Error

An Error in the Titles of Two Illustrations Shown in Last Issue of "Engineering"

In the March issue of Railway Engineering the titles of two illustrations on pages 91 and 92 were accidentally transposed. The title of the illustration on page 91 should read "Six Track Concrete Arch Bridge, Rahway, N. J., Penna. R. R." and the title of illustration, page 92, should be "Reinforced Concrete Arch Bridge, Clear Creek, near Rhodes, Ia., C. M. & St. P. Ry."

The Huntingdon & Hemmingford has been granted an extension of time in which to build this projected line. The proposed route is from Huntingdon, Que., east to Hemmingford, thence to a point on the International boundary.

H. W. Nelson, 14 South Canal street, Chicago, has been awarded contract for 6 miles of line near West Frankfort, Ill., for Illinois Central. All sub-contracts have been let.

REORGANIZATION OF THE U.-S.-L. CO. NOW ASSURED

In the proceedings before Judge Hazel of the U. S. District Court of the Western District of New York in Buffalo, March 30, the receivers announced to the court that a complete reorganization of the United States Light and Heating Company is now assured through the efforts of the Stockholders' Protective Committee. It appears that the latter represent over $2,000,000 of the $2,500,000 outstanding preferred stock and about $6,000,000 common stock, giving them the majority control.

The application of the receivers this morning was for the purpose of advising Judge Hazel to wind up the receivership and transfer the business and the property to the reorganized company.

It is understood that necessary notification to the stockholders and others will take some little time, and it appears, therefore, that the receivership will be discontinued some time in June. In the meantime the business will be conducted without interruption under the same operating management as heretofore, and the prospects for a large volume of business seem unusually bright. It may be noted that the receivership was instituted at a time of greatest business depression, during July, last year, and has continued successfully, even despite the adverse circumstances of receivership and the war abroad. The company has made a showing that has been regarded as remarkable. Judge Hazel congratulated the receivers and their attorneys upon the successful outcome of the case.

The mammoth plant at Niagara Falls has been doing a larger volume of business during the present month than for a year past, and orders booked for future deliveries are considered satisfactory. With the future of the company now assured, there will be a larger increase of orders that have been pending for some time past on account of the uncertainty in connection with the destinies of the company, which are now happily settled and which will result in the continued employment of a large body of men. As is usual in similar cases, the receivers will be authorized to sell the assets of the company, and, as stated before, the Stockholders' Reorganization Committee will purchase same for the benefit of creditors and the preferred and common stockholders whom they represent.

The receivers of the company are the Hon. James A. Roberts of New York City, Mr. James O. Moore of Buffalo, and Mr. J. Allan Smith of Niagara Falls, N. Y.

on Axis, and spread for each as prepared and copyrighted by the Adams & Westlake Company

IRON AND STEEL

The Atlantic Coast Line has placed an order with the Phoenix Bridge Company, of Phoenixville, Pa., for 250 tons of steel.

The Chicago, Milwaukee & St. Paul has ordered 165 tons of steel for roofs and lintels for buildings at Butte, Mont.

The Erie has placed orders for 5,000 tons of steel rails with the Bethlehem Steel Company and 9,000 tons with the Lackawanna Steel Company.

The International & Great Northern has ordered 1,500 tons of rails from the Tennessee Coal, Iron & Railroad Company.

The New York, New Haven & Hartford is inquiring for about 200,000 tie plates, its requirements for the year.

The Norfolk & Western is in the market for 4,000 tons of rails.

The Pennsylvania has ordered 400 tons of bridge material from the Fort Pitt Bridge Works.

The Maintenance of Way Department

How the Roadmaster Can Promote Efficiency

Descriptive of Details in Track Maintenance and Tie Renewals That Should Be Given Closest Attention

By A. W. Tabert, Roadmaster, Chicago & Northwestern

Roadmasters Promote Efficiency

The roadmaster can promote efficiency by obtaining the very best men possible for foremen and at all times selecting the best men from among his labor forces to fill any vacancies that may occur. By so doing they will encourage the men to stay with their work, as they may look forward to promotion. They should study closely the character of their foremen, in order that they know best how to handle them, as all men can not be handled in the same manner.

He must make each man proud of his position and let him know that he is a representative of the company for his respective section; make him feel that he is not merely to look after the low joints in the track, but that the railway's interests are just as much cared for by keeping stock off the right of way. He should also see that the ditches do not wash cinders on the farmers' pastures. "I impress upon my men to meet the farmer outside of the right of way in a friendly manner. In this way they would be led to see the farmer's side, and many little irritating things would never be brought up against the company.

"Our trackmen are a hard-working, conscientious body of men, and at all times anxious to learn; but with the many new appliances now in use, concerning which the trackmen have received little or no instruction, high efficiency can not be expected.

"I have seen track appliances improperly installed many times, resulting in short life for the device and not the benefit received that was desired from the money invested." The section foremen should receive proper instructions as to the method of performing certain work, also as to the use of tools, as good tools are expensive and will last for years if given reasonable care. Instructions should also be given to foremen, concerning the construction and maintenance of frogs, switches, and all track appliances so that the foremen may know how to make correctly minor repairs on the ground, which will not only save the cost of handling the material and shop expense, but will materially add to the life of the device.

The foreman should be trained to work according to a prescribed system, and to work in such a way as to take advantage of the different seasons of the year to do their various kinds of work. It is also a good plan to get the foremen as deeply interested in their work as possible in order that they may look after it as though it were their own enterprise and their own money were being expended thereon.

To promote efficiency and specialization, know each foreman as you do each bad spot in the track on your subdivision; know how much he can do alone, and try and give him what he is lacking. Encourage him to experiment with a piece that needs drainage, or be able to give him expert advice.

ECONOMY IN PUTTING IN TIES.

The usual manner of putting in ties is with three or more men. When the tie is put into the track in its proper position, one man measures it before it is spiked, with a mark made previously on the handle of his spike maul, or pick, to see if the end is the proper distance from the rail. It usually is not. The other men are standing idle waiting for this man to place it the proper distance.

When the spiking gang comes along they will again measure the tie from the end to be sure it is the correct distance from the rail, as frequently the ties are moved before they are spiked. Assuming that he and his two assistants find the tie distance correct, they have lost from one to two minutes discussing the distance.

To overcome all this delay have the foreman make a mark with chalk, measuring from the end of the tie to the line where the outside base of rail will come. In this way the tie can be put in the proper position by the men putting in the ties, and the spikers will see that it is in the proper place as the chalk mark will be there. Another method which I have used in spacing ties when track is being surfaced, is to have one man put a chalk mark on the base of the rail, commencing at the first bolt in the joint, and measuring off twenty-one inches along the entire rail. This will be the center of the tie. Then one or two men can go along with the lining bars and put the ties in the center of the chalk marks. In this way you will get the proper number of ties under the rail and have them square across the track; or use the blade of the shovel for spacing between the ties.

Now that the section forces are largely engaged in renewing ties, it is worth noting that there is no more fruitful field, from an economy standpoint, in the maintenance expense than in the renewal of ties. It is the largest single item of the cost in track maintenance. It is apparently, more neglected than any other item, largely because it requires constant and immediate supervision to prevent the renewals of good ties, while in other details of track maintenance, such as changing rail, angle bars, and ballasting, there is not the necessity for such close supervision, as you are aware that one and three-quarter million ties are used in one season.

It is natural that if the choice of ties for renewal is left for the foreman he will use all the ties he gets, unless it is made to his interest to save them. Thus, ties are frequently taken out of the track, which would have given several more years' service. After removing them it is too late to tell by inspecting the ties whether or not they should have been left in track, as they are generally split and injured in removing them. A certain section foreman who was replacing a string of perfectly good ties with new ones, in answer to the question why he was taking out good ties, replied, "I had plenty new ones on hand and I wanted to get rid of them as soon as possible." This is a type of attitude of most section foremen. The difficulty of obtaining a sufficient number of ties in certain seasons makes the men wasteful of them when ties are plentiful.

Under no circumstances should ties that are badly decayed or broken be left in track, for this is not true economy. When it becomes necessary to renew a large percentage of ties in any one season it is usually because they have been neglected and as "A stitch in time saves nine," so a tie in time may save others. For instance, we take out switch ties on a busy lead; they are spike killed, rail cut down, etc. These ties can be used by turning them over and putting them in on some track where there is not so much switching going on. Also the ties that we

Exhibitors at the National Railway Appliances Association

A Partial List of Exhibitors at the Coliseum, Chicago, During the Week of the American Railway Engineering Association's Annual Convention

The Adams & Westlake Company, Chicago, Ill., displayed signal lamps, switch locks, unity fixtures for station warehouse and freight terminal lighting. Represented by A. S. Anderson, C. B. Carson, H. G. Turney, Wm. J. Piersen, Thos. A. Galt, J. F. Stender and G. L. Walters.

The Ajax Rail Anchor Company, Chicago, Ill., displayed double grip rail anchors. Represented by F. B. Bradley and H. G. Elfborg.

The American Guard Rail Fastener Company, Philadelphia, Pa.—Vaughan guard rail clamps, anchor guard rail clamps, anchor No. 2 guard rail clamps, tie plate guard rail fasteners. Represented by Mr. Vaughan and L. T. Burwell.

The American Steel and Wire Company, Chicago, Ill.—Rail bonds, trolley wire, insulated and bare copper wire, woven wire fence, gates, steel fence posts. Represented by L. P. Shanahan, B. H. Ryder, J. W. Collins, A. W. Fronde, M. E. Evans, C. J. Boone, J. F. Alexander, C. Denniston, Frank Conkling and A. W. Durant.

American Valve & Meter Company, Cincinnati, O.—Poage automatic water columns; Fenner non-freezable drop spout; Poage automatic float valves, tank fittings, etc.; Anderson economy and quick repair switch stands; interlocking switch stands and safety switch locks; safety appliances. Represented by Mr. J. T. McGarry and F. C. Anderson.

The American Vulcanized Fibre Company, Wilmington, Del.—Vul-Cot railroad insulation, vulcanized fibre insulation, boxes, cans, etc. Represented by C. C. Bell, W. A. Jordan and John Barron.

The Atlas Preservative Company of America (Inc.), New York, N. Y.—Atlas "A" weed killer and track preservative. Method of applying Atlas "A" weed killer, Atlas "E" boiler preservative and Atlas "Ruskilla" protective paint. Represented by R. N. Chipman, B. G. Thompson and J. Kramer.

The Automatic Train Control & Signal Company, Pittsburgh, Pa.—Electric interlocking machine and train control apparatus. Represented by Gardner B. Gray, Guy P. Thurber, A. G. Williamson and A. E. Gray.

The Boss Nut Company, Chicago, Ill.—Boss lock nuts. Represented by J. A. MacLean, T. W. Fogg and M. C. Beymer.

Bowman, T. B., Chicago, Ill.—Efficiency one-piece rail anchor. Represented by T. B. Bowman, A. S. Flowers, T. H. Fowler, W. D. Thomas and C. P. Williams.

Brach, L. S., Supply Co., New York, N. Y.—Automatic flagman, track controlling devices, hydrogrounds, arresters, time recorders, switchrods, testing instruments, solderall, etc. Represented by L. St. Clair Brach and Godfrey Gort.

Bryant Zinc Company, Chicago, Ill.—Railway signal supplies, highway crossing signals, "Autoflags," Waterbury batteries, bells, relays, concrete battery vaults, electrical supplies. Represented by Stanley C. Bryant, Geo. A. Blackmore, Wm. P. Graves, Jerry P. Costigan, John F. Gubbins, Ward Leary, Robert P. Klink, Harry F. Worden.

The Buda Company, Chicago, Ill., displayed motor cars, bumping post, electric headlights, jacks, crossing gates, replacers, switch stands, tool grinders, track drills, bonding drills, electric freight house and warehouse trucks, hand and push cars, etc. Represented by C. H. Bull, J. L. Artmaier, H. C. Beebe, W. Krause, T. H. Wheeler, L. Hamill, N. C. Study, J. J. Gard, W. C. Dyer, F. E. Place, Wm. P. Hunt, Jr., L. M. Viles, M. A. Ross, E. Johnson and W. F. Hebard.

The Carnegie Steel Company, Pittsburgh, Pa., displayed steel cross ties; Duquesne rail joints; Braddock insulated joints; passenger and freight car wheels; rolled steel locomotive pistons; nickel-plated samples of rails, ties, joints and piling. Represented by John S. Unger, C. F. W. Rys, Chas. E. Dinkey, John McLeod, H. D. Williams, John Oursler, L. P. Lincoln, Louis C. Lustenberger, Norman M. Hench, P. W. O'Brien, D. E. Sawyer, Orin Baker, Edwin S. Mills, C. B. Friday, G. E. Dix, H. van Zandt and G. W. Landrus.

Chicago Bridge & Iron Works, Chicago, Ill.—Model steel water tanks and enlarged pictures of tanks, coaling stations, etc. Represented by George T. Horton, M. J. Trees, C. M. Ladd, C. S. Pillsbury, K. I. Small, H. B. Murphey, F. L. Cook, H. B. Horton, R. H. Murray, J. C. Phelps, J. C. Vosburgh, J. L. Zeller and G. S. Sangdahl.

Chicago Railway Signal & Supply Co., Chicago, Ill.—Various types highway crossing alarms, crossing signs, locomotive type crossing bells, magnet and motor operated, the Chicago electric flag, cable poles, relay boxes, indicators, relays, interlocking forgings and fittings, Chicago rail expander, Chicago track drill and a complete line of signal accessories and maintenance supplies. Represented by E. W. Vogel, W. M. McClintock, Wm. H. Dayton, P. P. Williams, R. Harvey White, Arthur C. Dunne, W. C. Martin, Carl Suhr, F. L. Rainbow, H. C. McNeil and W. A. Schroeder.

Cleveland Frog & Crossing Company, Cleveland, O.—Frogs, crossings, switches and switch stands. Represented by G. C. Lucas, Geo. Stanton and L. G. Parker. Spaces 91 and 110.

The Cleveland Railway Supply Company, Cleveland, O.—Railway supplies. Represented by W. S. Newhall, F. A. Peck and S. W. Linn.

The Commercial Acetylene Railway Light and Signal Co.'s booth showed an attractive transparency representing a signal light and showing views of Lehigh Valley and other installations of the Flash Light Signal. O. F. Ostby and H. G. Doran were the representatives.

The Indianapolis Switch & Frog Co. exhibited the following: Portable electric track welder; portable track grinder; R-N-R type of solid manganese frog; R-N-R type of solid manganese crossing; Indianapolis type standard manganese crossing; manganese tipped switch points; sectional exhibit unit drilled and bolted frogs and crossings; miniature standard railroad construction; the Eymon continuous crossing; electric welded rail joints and bonds; electric welds of iron, steel, manganese and brass. The company also exhibited and demonstrates one of its latest developments, the Indianapolis high-duty blue bolt, made of Indian-electric steel with a tensile strength of 135,000 lbs. per square inch, which bolt is especially designed for bolting frogs and crossings either for repairs or in new work. The company was represented by the following: E. C. Price, W. H. Thomas, T. L. Hanley, H. H. Murray, W. L. Walker, W. E. Harkness, J. H. Eymon, J. C. Jameson, C. S. Sale, W. M. Whitenton.

The Kilbourn & Jacobs Mfg. Co., Columbus, Ohio, showed parts and photographs of an automatic air dump car for railroad construction and ditching work. David Greene, representative.

Hall & O'Neil, Homer, Ill., showed a patented steel and concrete railroad tie; the inventor, Mr. H. B. Hall, in charge.

The Madden Company showed the improved three man track laying machine; a rapid bolt tightener; a tie spacer and a switch point straightener. The representatives were H. C. Holloway, P. H. Madden, T. D. Crowley, I. L. Walker.

The Ingersoll-Rand Co. of Illinois showed the imperial tie tamping outfit; little David pneumatic tools; and Crown sand rammers. W. H. Armstrong, New York representative, in charge, assisted by J. R. Randle.

The National Malleable Castings Company, Cleveland, O., displayed malleable iron anti-rail creepers, rail braces, tie plates, washers and steel wrecking hooks. Represented by T. W. Aishton, J. J. Byers, J. A. Slater, J. H. Slawson and L. S. Wright.

National Standard Company, Niles, Mich.—Bonding drills, grinders, flat drills, cattle guards, railway jacks. Represented by W. H. Parkin, E. Cook, W. S. Runnels, C. R. Westcott, F. A. Buckley, R. L. Brown, H. M. Buck, W. F. Harrah and J. B. Given.

Joseph Dixon Crucible Company, Jersey City, N. J.—Graphite products for railroads, Dixon's silica graphite paint, airbrake and triple valve graphite, boiler graphite, graphite grease. Represented by H. W. Chase, F. B. Gibbs, Jr., and J. E. Simpson.

The Duff Manufacturing Company, Pittsburgh, Pa.—Genuine Barrett track and automatic lowering jacks, Duff ball bearing high speed screw jacks and Duff ball bearing journal box jacks. Represented by Messrs. T. A. McGinley, E. A. Johnson, C. N. Thulin, G. A. Edgin and B. W. Parsons.

Thomas A. Edison, Inc., Bloomfield, N. J.—Edison primary cells. Represented by E. E. Hudson, F. J. Lepreau, E. W. Brown, P. B. Hyde, E. McGall, P. A. Garrity, I. P. Rodman and O. P. Rose.

Edison Storage Battery Company, Orange, N. J.—Batteries for interlocking. Portable batteries for automatic block signals, track circuits, car lighting, telephone and telegraph. Representing by H. G. Thompson, F. V. McGinness, W. F. Bauer and C. A. Luckey.

The Electric Railway Improvement Company, Cleveland, O.—Samples of electric weld and copper weld rail bonds. Apparatus for installing same. Represented by M. T. Stanton and Gerald Howatt.

The Electric Storage Battery Company, Philadelphia, Pa.—Gravity Charging signal outfit. Maps showing use of Gravity Charging outfit. Miniature Block Signal operated by Exide Battery. Samples, batteries and plate. Represented by G. H. Atkin, T. Milton, H. M. Beck, G. H. Morris, P. G. Downton and T. A. Cressey.

Eymon Continuous Crossing Company, Marion, Ohio.—Continuous crossings. Represented by W. E. Harkness.

Fairbanks, Morse & Co., Chicago, Ill.—20 h.p. type oil "Y" engine operating 5 in. centrifugal pump, in actual service, and driving electric generator, furnishing special lights for exhibit. No. 11 telescopic spout standpipe. Represented by W. W. Adams, G. J. Akers, J. P. Brown, F. M. Condit, E. P. Drinker, Robert Elder, J. C. Flanigan, E. M. Fisher, F. F. French, C. T. Fugitt, E. C. Golladay, J. T. Gratiot, D. J. Higgins, G. Howard, J. George Jones, L. J. Jones, U. C. Kalar, F. E. Kaeppell, T. C. Kennedy, D. H. Lee, L. H. Matthews, E. E. Pendray, F. V. Roy, J. F. Snarenberger, A. A. Taylor, H. E. Vergosen, E. D. West, C. H. Wilson and F. N. Whitesell.

Fairmont Gas Engine and Railway Motor Car Company, Fairmont, Minn.—Railway motor car mowing machine, electric generating set, section and inspector motor cars, handcar engines. Represented by F. E. Wade, H. E. Wade, R. B. Ballard, I. Sawyer, W. F. Kasper and M. J. Egleston.

Federal Signal Company, Albany, N. Y.—Type "4" signal, top post and bottom post mechanism, A. C. & D. C. operation; Federal power interlocking machine; type "4" switch movement; A. C. and D. C. relays; electric locks; circuit controllers, etc. Represented by Messrs. Renshaw, Henze, Ware, Turreff, Hackett, Richard, Kelly, Ober and Loughbridge.

The Frictionless Rail, Boston, Mass.—Frictionless rail for curves. Represented by F. A. Barbey, S. W. Simonds, G. H. Bryant, W. E. Cade, Jr., and T. F. Dwyer, Jr.

General Electric Company, Schenectady, N. Y.—Automatic door, substation and locomotive head lighting set and signal lighting arresters. Represented by B. F. Bilslander, C. C. Bailey, J. Roberts, S. W. McCune and R. H. Parker.

General Railway Signal Company, Rochester, N. Y.—One 16-lever Model 2 unit-lever type electric interlocking machine, equipped with rotary circuit controllers, lever lights and mechanical time release; operating switchboard; two-arm Model 2A, 110 volt non-automatic top-of-mast signal; Model 2A, 110 volt semi-automatic signal; 110 volt Model 5 switch machine; relays and indicators. Model 2A low-voltage power signals; relays, and switch circuit controllers. One 8-lever electro-mechanical interlocking machine; Garber switch-and-lock movement; 10 volt Model 2A top-of-mast signal; 10 volt Model 2A base-of-mast signal; three-position motor relay; track and line relays; "Copper-cup" ground plate; and Model 1B lightning arrester. Model 2A base-of-mast signal, equipped with 110 volt, 60 cycle induction motor; light signal; line and secondary transformers; impedance bond; track and line relays; push-button switch indicator with switch circuit controller; stub pole, equipped with line transformer, plug cut-outs, lightning arresters, connections, etc. One six-contact selector, one answer-back selector, controlling signal, two bells, line relay, silencer equipment, key cabinet and miniature track circuit demonstrating the "OS" arrangement. Track and signal diagrams showing the absolute-permissive block system. Model 5 low-voltage switch machine for the operation of outlying switches. Map showing signaling on Brooklyn Rapid Transit System. Colored photographic enlargements showing various signal installations. Represented by M. R. Briney, P. E. Carter, W. W. Coleman, S. M. Day, L. E. Dodge, F. L. Dodgson, W. S. Henry, W. K. Howe, F. H. Jones, R. F. Kelley, H. W. Lucia, F. W. Moffett, G. D. Morgan, C. O. Poor, F. W. Rizer, W. W. Salmon, V. I. Smart, H. M. Sperry, L. Thomas, A. Thomas, S. N. Wight, M. Wuerpel, W. R. Young and Sidney G. Johnson.

Gordon Primary Battery Company, Waterbury, Conn.—Gordon primary cells. Gordon track battery. Represented by G. A. Nelson, E. A. Everett and O. S. Flath.

The Gosso Company, Chicago, Ill.—Gosso beds. Represented by A. E. Gosso, T. J. Burke, L. Grant and D. Garrick.

H. B. Hall, Homer, Ill.—Concrete and steel ties. Represented by H. B. Hall.

Hall Switch and Signal Company, New York, N. Y.—Automatic signal apparatus, electric interlocking apparatus, telephone and telegraph selectors, railway crossing alarms and signals. Represented by W. J. Gillingham, L. H. Thullen, W. A. Peddle, H. L. Hollister, O. B. Frink, Roy Connell, D. R. Day, C. S. Rhoads and J. A. Ritter.

The Hatfield Rail Joint Manufacturing Company, Macon, Ga.—The Hatfield rail joint and Hatfield rail joint fastenings. Represented by Walter T. Johnson, DeWitt McCrary, U. R. Hatfield, T. B. Bowman and C. P. Williams.

Hayes Track Appliance Company, Richmond, Ind.—Hayes derails, models C, CX, E, EX, HP and HXP, with operating stands and target stands. Represented by E. L. Ruby.

Hoeschen Manufacturing Company, Omaha, Neb.—Railway signals. Represented by H. P. Ryner, H. A. Holdrege, R. Wood, W. D. Cleveland, R. A. Fry and E. Ehrig.

Hubbard & Co., Pittsburgh, Pa.—Railroad track tools, track shovels and locomotive scoops. Represented by R. L. Mason, W. S. Perry, O. W. Youngquist and George H. McCammon.

Indianapolis Switch & Frog Company, Indianapolis, Ind.—Portable electric track welder, portable track grinder, R-N-R type of solid manganese frog, R-N-R type of solid manganese crossing. Indianapolis type standard manganese crossing, manganese tipped switch points, sectional exhibit unit, drilled and bolted frogs and crossings, miniature standard railroad construction, the Eymon continuous crossing, electric welded rail joints and bonds, and electric welds of iron, steel, manganese and brass; Indianapolis high duty blue bolt of Indian-electro steel for bolting frogs and crossings. Represented by E. C. Price, W. H. Thomas, T. L. Hanley, H. H. Murray, W. L. Walters, W. E. Harkness, J. H. Eymon, J. C. Jameson, C. S. Same and W. M. Whitenton.

Ingersoll-Rand Company, New York, N. Y.—Imperial tie tamping equipment, including a self-propelled gasoline-driven air compressor car supplying compressed air to operate two Imperial tie tampers shown in operation on a short section of track. Represented by W. H. Armstrong, C. W. Melcher and J. R. Randle.

The International Steel Tie Company, Cleveland, Ohio.—Steel crossing substructure with crossing section on it. Section of track using insulated twin steel ties. Plate steel tie with rail electrically welded to it. Represented by William P. Day, William C. Mahon and L. C. Shank.

Jaeger Machine Company, Columbus, Ohio.—Concrete mixer. Represented by W. H. Peters.

The Julian-Beggs Signal Co., Terre Haute, Ind., have been perfecting for the last eight years their Auto Speed Controller. Mr. Stephen Smith, sales manager, was in charge of the exhibit. The plant is located in Detroit. M. H. Hovey, signal engineer; Thos. E. Clark, electrical engineer.

Kelly-Derby Company, Chicago, Ill.—Pumps, gasoline and oil engines, deep well equipment, strainers and cylinders, wire cloth, steel warehouse trucks, crucibles, combination rail brace and tie plate, rail laying machine, full line of rubber goods. Represented by C. W. Kelly, W. B. Holcomb, H. D. Mathews, C. Penberthy, H. L. Bachman, S. D. Baldwin.

The Kerite Insulated Wire & Cable Company, Inc., New York, N. Y.—Insulated wires and cables and insulating tapes. Represented by R. D. Brixey, Azel Ames, P. W. Miller, J. W. Young, B. L. Winchell, Jr., and G. A. Graber.

Keuffel & Esser Company, Hoboken, N. J.—Surveying instruments and drawing material. Also a new device—the Optical Plummet. Represented by F. M. Praill, A. W. Keuffel, H. B. Huster, Joseph Lamb and Edward Veasey.

Lackawanna Steel Company, Lackawanna, N. Y.—Tie plates, joint plates, improved splice bars, steel sheet piling, deseamed rails, rails, spikes, bolts and structural material. Represented by C. R. Robinson, A. P. Van Schaick, F. E. Abbott, C. H. Hobbs, J. L. Hench, H. H. Barbour, J. Chandler and A. H. Weston.

Lidgerwood Manufacturing Company, New York, N. Y.—Photographers of hoisting and conveying machinery, including unloaders, cable ways, excavators, logging machinery and steam and electric mining and contractors' hoists. Represented by F. B. Knight, O. D. Weaver, W. R. Elden, W. G. Wilmot, G. N. Crawford, Jr., and William Kinsley.

Louisiana Red Cypress Company, New Orleans, La.—Louisiana red cypress, trunking and capping, crossarms, car siding and roofing, railroad ties, fence posts, etc. Represented by C. A. Nesom, H. P. Altman and F. N. Snell.

M. W. Supply Company, Philadelphia, Pa.—Vaughan rail anchor. Represented by D. L. Vaughan, L. T. Burwell and L. Parker Lloyd.

The Madden Company, Chicago, Ill.—Three man track layer, rapid nut tightener, switch point straightener, the Blair tie spacer. Represented by H. C. Holloway, T. D. Crowley, V. L. Walker, J. C. Barr and F. C. Webb.

C. F. Massey Company, Chicago, Ill.—Reinforced concrete pipe, unit and monolithic portable houses, battery wells, piling and concrete bridges for track elevation. Represented by C. F. Massey, A. Christ, Jr., Chas. Gilman, E. M. Hatheway, D. A. Hulgren, H. W. Wilder and George B. Massey.

Metal Post and Culvert Company, Niles, Ohio.—T. & T. metal fence posts and nestable culverts, Lohmanized products. Represented by E. D. Thompson.

Morden Frog & Crossing Works, Chicago, Ill.—Manganese rigid frogs, solid and rail bound, Unity switch stand, Morden Safety switch lock, guard rail clamps, etc. Represented by I. T. Hartz, A. C. Smith, W. H. Hartz and W. J. Morden.

Mudge & Co., Chicago, Ill.—Mudge inspection and section motor cars. Represented by Burton W. Mudge, R. D. Sinclair, George W. Bender, Sherman C. Amsden and Blake C. Howard.

George P. Nichols & Bro., Chicago, Ill.—Transfer table (working model), portion of turntable tractor. Represented by George P. Nichols, S. F. Nichols and Henry Fries.

Northwestern Motor Company, Eau Claire, Wis.—"Casey Jones" motor cars and handcar engine. Represented by R. R. Rosholt and K. Rosholt.

The Okonite Company, New York, N. Y.—Insulated wires and cables. Represented by Lewis G. Martin, F. J. White, W. M. Candee, W. T. Kyle and J. D. Underhill.

Spencer Otis Company, Chicago, Ill.—Economy tie plates, Absolute lock nuts, Tiger steel bunks. Represented by Carter Blatchford, T. W. Blatchford, W. L. DeRemer, J. T. DeRemer and H. H. Hart.

The P. & M. Company, Chicago, Ill.—P. & M. rail anti-creeper, bond wire protector and Crane guard rail retainer. Represented by F. A. Poor, P. W. Moore, F. A. Preston, F. N. Baylies, George E. Johnson, A. R. Sutter, D. T. Hallberg, R. W. J. Harris and W. W. Glosser.

Positive Rail Anchor Company, Louisville, Ky.—Positive one-piece rail anchor, Betts anti-creeper tie plate, Economy separable switch point, Economy foot guard, Betts guard rail holder. Represented by W. M. Mitchell, J. C. Haswell, W. E. Marvel, W. A. Wallace, J. A. Shoulty and L. C. Ferguson.

The Prest-O-Lite Company, Inc., Indianapolis, Ind.—Working exhibit of portable welding outfit employing Prest-O-Lite dissolved acetylene in safety storage cylinders, actual welding and cutting operations. Represented by H. S. Smith, W. H. Adkinson, C. M. Wills, Stanley Winger, W. L. Harris and S. R. Sutton.

Pyrene Manufacturing Company, New York, N. Y.—Pyrene fire extinguishers, Pyrene liquid, Pyrene vehicle brackets. Represented by E. L. Kent and J. D. Cole.

The Q. & C. Company, New York, N. Y.—Bonzano rail joint, rolled steel step joint, Vaughan rail anchors, guard rail clamps, rail benders, derails, tie plates, adjustable braces, rail saw. Represented by C. F. Quincy.

The Rail Joint Company, New York, N. Y.—Continuous, Weber, Wolhaupter and 100 per cent rail joints. Represented by L. F. Braine, Percy Holbrook, McLeod Thomson, V. C. Armstrong, J. A. Greer, E. A. Condit, Jr., G. C. Isbester, A. C. Chapman and W. A. Chapman.

The Railroad Supply Company, Chicago, Ill.—Tie plates and derails, highway crossing protective devices; also signal accessories for steam and electric railways. Represented by H. S. Hawley, E. H. Bell, J. M. Fitzgerald, H. M. Buck, Geo. M. Kenyon, F. C. Webb, R. D. Hawley, Geo. T. Cook, A. H. Smith, H. G. Van Nostrand, Geo. Nibble, P. F. Hanley, R. S. Prentice and J. M. Spangler.

Ramapo Iron Works, Hillburn, N. Y.—Automatic safety switch stands, manganese reinforced switches and frogs, guard rail clamps, rolled shoulder switch slide plates, etc. Represented by Thomas E. Akers, Arthur Gemunder, W. C. Kidd and James B. Strong.

Reading Specialties Company, Reading, Pa.—Samson type rail benders, Reading reversible rail bender, rail straighteners, swing joint guard rail clamp, compromise joint, car replacers. Represented by B. J. Buell and R. G. Ross.

Risley and Associates, Dalton, Chicago, Ill.—Ballou safety rail bolt nut and Ballou insulated joint. Represented by C. E. Ballou, C. C. Zimmerman and Dalton Risley.

Sellers Manufacturing Company, Chicago, Ill.—Sellers anchor bottom tie plates. Represented by J. M. Sellers, G. M. Hogan, R. A. Van Houten and T. F. Geraghty.

Shepherd Automatic Switch Company, Montgomery, Ala.—Automatic switch closing device. Represented by W. L. Shepherd.

Signal Accessories Company, New York, N. Y.—Signal materials. Represented by F. C. Lavarack.

Simmen Automatic Railway Signal Company, Buffalo, N. Y.—Automatic speed control, continuous cab signals, automatic recording of train movements and central control of signals. Represented by P. J. Simmen, C. E. Chatfield, L. Ringer and G. P. Simmen.

Standard Underground Cable Company, Pittsburgh, Pa.—Electric wires and cables of all kinds for light, power, telegraph, telephone and railway signal service; also cable terminals for outdoor and indoor service. Represented by R. B. Wilcox, R. C. Houck, W. M. Rogers, E. J. Pietzcker, E. F. Norton and H. K. Weld.

Staple Post Mold Company, Westerville, O.—Fence post molds and machinery for making the Staple cement post. Represented by H. L. Pettit and R. B. Bennett.

The Templeton, Kenly & Co., Ltd., Chicago, Ill.—Simplex track and ballast jacks, Simplex emergency jacks, Simplex industrial jacks, Simplex car jacks, Simplex motor jacks. Represented by Alfred E. Barron, E. J. Curran, Harry M. Hood, Arthur C. Lewis, Thomas L. Stitt and Walter B. Templeton.

Titanium Alloy Manufacturing Company, Niagara Falls, N. Y.—Ferro carbon-Titanium, Titanium-treated steels, Titanium aluminum bronze. Represented by H. H. Cook and A. C. Hawley.

The Union Switch & Signal Company, Swissvale, Pa.—Position light signal, A. C. electric interlocking, low voltage switch movement, enclosed electro-pneumatic switch movement, direct current crossing bell, Style "B" and Style "S" signals, D. C. and A. C. "T-2" signals, Model 14 light signal, "P-4" electro-mechanical interlocking machine, three-way interlocked electrically locked indicator and circuit controller, D. C. and A. C. relays, indicators and locks, transformers, impedance coils, clockwork time release, spiral switch guard, Keystone insulated rail joints and lightning arresters. Represented by W. D. Uptegraff, T. W. Siemon, W. H. Cadwallader, J. S. Hobson, J. P. Coleman, C. E. Denney, Aaron Dean, W. W. Talbert, S. L. Shober, F. J. Ackerman, J. F. Talbert, J. L. Loucks, F. H. Nicholson, J. W. White, L. F. Howard, C. O. Harrington, M. D. Hanlon, Geo. Marloff, A. C. Livermore, V. K. Spicer, H. W. Griffin, T. H. Patenall, J. B. Struble, H. R. Sheene, H. A. Wallace, J. J. Cozzens, J. E. Saunders and S. E. Gillespie.

Verona Tool Works, Pittsburgh, Pa.—Track gauges, levels, jacks, nut locks and track tools. Represented by H. S. Paul, H. Fisher, W. H. Remmel, E. Woodings and H. C. Mull.

Western Electric Company, New York, N. Y.—Train dispatching selective equipment; lamps; telephone equipment used in train dispatching; line anchors; wire and cables. Represented by J. C. Binning, Geo. H. Porter, G. K. Heyer and J. B. Harlow.

Wm. Wharton, Jr., & Co., Inc., Philadelphia, Pa.—Switches, frogs, switchstands, switch rods, insulated switch rods, guard rail clamps, etc. Represented by R. C. McCloy, H. F. McDermott, A. S. Partridge, Thomas O'Brien, G. R. Lyman, J. S. Morrison and J. R. Bolgiano.

Wyoming Shovel Works, Wyoming, Pa.—Mayari steel shovels and scoops for track. Represented by G. E. Geer.

The Creepcheck Company, Inc., New York, N. Y.—Dinglage Creepcheck anticreepers. Represented by M. S. Schmalholz.

Crerar, Adams & Co., Chicago, Ill.—Ideal mixers, Novo pumping outfit, Calumet track drills, Eureka bonding drills, Hercules steel trucks and other devices. Represented by Russell Wallace, W. I. Clock, J. A. Martin, G. D. Bassett, T. W. Barrett and S. M. Roberts.

D. & A. Post Mold Company, Three Rivers, Mich.—Machines for making cement fence posts, samples of posts, reinforcements. Represented by G. H. Dougherty, O. Dougherty and C. J. Spaulding.

Daniels Safety Device Company, Chicago, Ill.—Bulldog nut. Represented by T. M. Daniels, A. S. Armstrong, J. C. Holschemacher, W. D. Collins and L. F. Crossette.

Detroit Graphite Company, Detroit, Mich.—Graphite paint for structural steel. Represented by Tom R. Wyles, L. D. Mitchell, B. O'F. Randolph, A. H. Kuerst, G. H. Varney, Eston Randolph and J. J. Hogan.

Dilworth, Porter & Co., Limited, Pittsburgh, Pa.—Railroad spikes, railroad tie plates. Represented by W. F. Schleiter, C. Stein and Joseph Dilworth.

Railway Construction.

Surveys are about completed for proposed line of McConnellsburg & Fort Loudon (electric) from McConnellsburg, Pa., to Fort Loudon, and construction contracts will be let about May 1. Bids are now being received. The company has been chartered, has secured rights of way, and capital stock of $60,000 is nearly all subscribed and paid in. Subscriptions for the bonds are now being taken. The route crosses a mountain and connects with the Cumberland Valley R. R. at Fort Loudon. The estimated cost is $250,000.

The Norfolk & Western has let contracts for building a low-grade line between Burkeville, Va., and a point near Pamplin, about 36.5 miles.

PERSONALS

Effective April 1, Mr. Geo. A. Butler was appointed acting assistant engineer of the Belleville Division of the Grand Trunk, with headquarters at Belleville, Ont., vice Mr. C. S. Ogilvie, who enlisted for active service abroad.

L. F. Hounbladd, engineer maintenance of way, Missouri, Kansas & Texas, has been appointed chief engineer, with headquarters at Dallas, Tex.

A. A. Mathews, assistant engineer maintenance of way, has been promoted to engineer maintenance of way of the Missouri, Kansas & Texas, with headquarters at Dallas, Tex.

P. Dowling, general roadmaster of the Delaware, Lackawanna & Western, at Scranton, Pa., died in that city on March 6.

Samuel Tobias Wagner was appointed chief engineer of the Philadelphia & Reading on April 6, with headquarters at Philadelphia.

At the recent annual meeting of the American Railway Engineering Association, Professor A. N. Talbot, who is in charge of Theoretical and Applied Mechanics of the University of Illinois, was elected a member of the Board of Directors.

P. S. Biegler, Associate in Electrical Engineering at the University of Illinois, recently assisted in the organization of a practical course in electrical testing for mine employees at Harrisburg, Illinois.

F. H. Newell, Consulting Engineer with the U. S. Reclamation Service, and until recently Director of that Service, delivered a lecture on "The Engineering and Economic Results of Reclamation Work" before the faculty and students of the College of Engineering of the University of Illinois on March 24.

W. A. Slater, First Assistant in Theoretical and Applied Mechanics in the Engineering Experiment Station of the University of Illinois, is conducting an extensive series of tests to determine the strength of gypsum as a building material. His tests include studies of the proper proportion of water to be used, and of various methods of mixing.

Professor D. W. Mead of the University of Wisconsin gave a lecture on "Engineering Work in China" before the faculty and students of the College of Engineering of the University of Illinois on March 17. Professor Mead is a member of the commission which was appointed a few years ago to investigate the problem of flood prevention along certain of the great rivers of China.

A. P. Apperson, general superintendent of the Utah lines of the Denver & Rio Grande, at Salt Lake City, Utah, has been appointed also general superintendent of the Salt Lake City Union Depot Company, vice William Otteson, superintendent, deceased.

W. F. Schaff has been appointed superintendent of the Toledo Division, New York Central, vice E. B. Cook, deceased.

E. R. Bissell has been appointed superintendent, Detroit Division, New York Central, vice W. F. Schaff, transferred.

E. D. Moon has been appointed assistant superintendent, Michigan Division, New York Central, vice E. R. Bissell, promoted.

J. R. Todd has been appointed assistant superintendent Franklin Division, New York Central, vice E. D. Moon, transferred.

T. J. Wyche, chief engineer of the Western Pacific, has been appointed assistant general manager, with headquarters at San Francisco, Cal., and C. E. Benton has been appointed superintendent of dining cars, with headquarters at Oakland, Cal.

E. J. Pearson, vice-president of the Missouri Pacific Railway system, at a meeting of the new board of directors of the Texas & Pacific Railway, March 25, was elected vice-president of the latter road. Other officers of the Texas & Pacific were re-elected.

Joseph T. Richards, Consulting Engineer of Maintenance of Way, retired from the active service of the Pennsylvania Railroad on March 1, 1915, and was placed on the company's "Roll of Honor." Mr. Richards was largely influential, during the many years he was head of the Maintenance of Way Department, in establishing the present high standards of the company for track, stations, bridges and operating yards.

Mr. Richards was born near Rising Sun, Md., February 12, 1845. He was educated largely at the West Nottingham Academy, in Cecil County, Md.

He entered the service of the Pennsylvania Railroad Company in August, 1869, as rodman and transitman, during the construction of new shops at Altoona. On June 1, 1870, he was appointed supervisor from Harrisburg to Newport, in which position he continued until October 16, 1871, when he accepted the position of chief engineer in locating and constructing small railroads in Maryland.

On May 25, 1874, Mr. Richards accepted the position of mining engineer with the Cambria Iron Company.

He returned to the service of the Pennsylvania Railroad Company on March 1, 1875, as supervisor from Newport to Granville, Pa. On March 20, 1876, he was promoted to assistant engineer, maintenance of way, of the Pennsylvania Railroad. From June, 1877, to March, 1883, he was principal assistant engineer of the United Railroads of New Jersey Division, and from March, 1883, to June 24, 1885, assistant to the chief engineer. On the last-mentioned date he was appointed by the president assistant chief engineer.

On March 1, 1893, when a change was made in the organization, Mr. Richards became engineer of maintenance of way; on June 1, 1903, chief engineer of maintenance of way; and on June 16, 1913, he was made consulting engineer maintenance of way.

He largely influenced the working plans as adopted for the New York, Long Island and Washington terminals.

Mr. Richards' total service with the company was 44 years and 6 months.

J. O'Connor, assistant roadmaster, St. Louis Southwestern, at Mt. Pleasant, Tex., has been appointed roadmaster, vice J. J. Hughes, deceased.

T. Mahoney has been appointed supervisor of track of the Baltimore & Ohio Southwestern Railroad, with headquarters at Storrs, Ohio, in charge between Oakley and Anderson's Ferry; D. Cassin has been appointed supervisor, with headquarters at North Vernon, Ind., in charge of main line territory 62 miles east from North Vernon; W. M. Downey has been appointed supervisor with headquarters at North Vernon, in charge of main line territory to Whitcomb and from North Vernon to New Albany and Jeffersonville, and T. Rowland, with headquarters at Seymour, is supervisor in charge of main line territory from Whitcomb to Washington, including the New Bedford branch.

SUPPLY TRADE NEWS

ANNUAL MEETING NATIONAL RAILWAY APPLIANCES ASSOCIATION

The annual meeting of the National Railway Appliances Association was held Tuesday morning, March 16, at the Coliseum, Chicago. A motion was made and carried dispensing with the reading of the minutes of the last meeting, but during the discussion of the question it was brought to the attention of the administration that it was quite desirable, especially for out-of-town members who did not have easy access to the secretary's office, to receive a printed report.

President Hench in his address called attention to the advantage of confining the exhibit this year to the Coliseum. All the space was rented, all collections had been made and there was a small waiting list of concerns desiring to exhibit. Treasurer Kelly reported that this year the association would probably show a profit of a little over $700.

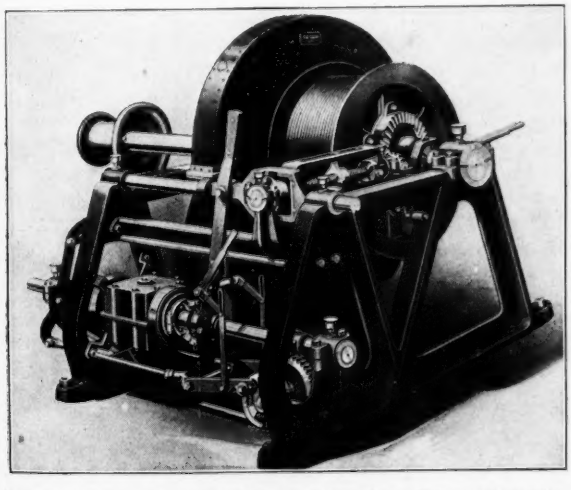
A rising vote of thanks was given the retiring administration and F. R. Wyles, retiring director, for the very efficient work done in the face of unfavorable conditions. The following officers were elected for the ensuing term:

President, Philip W. Moore, P. & M. Company; vice-president, H. M. Sperry, General Railway Signal Company; secretary, Bruce V. Crandall; treasurer, C. W. Kelly, Kelly-Derby Company.

Directors: Three years—P. C. Jacobs, H. W. Johns, Johns-Manville Company; R. C. McCloy, Wm. Wharton, Jr., & Co., Inc.

THE SNOW IMPROVED AUTOMATIC REVERSIBLE HOIST

The T. W. Snow Construction Company, Ellsworth Building, Chicago, Ill., are now manufacturing an improved automatic reversible hoist. This hoist is worm gear driven instead of link chain driven, as was the case in regular reversible hoist formerly made by this company. The illustration shows very clearly the adaptation of this drive.

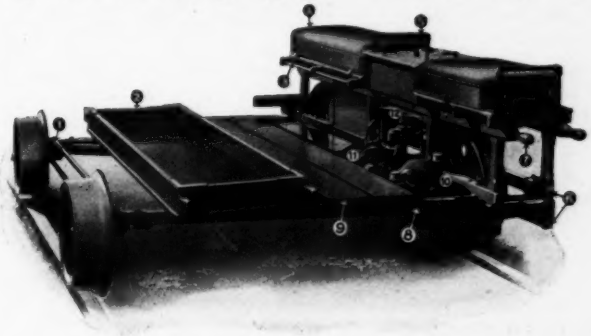


Snow Automatic Reversible Hoist. Worm Gear Drive. Rear View.

The advantage of this improvement is that it makes impossible the "running away" of the hoist, as the worm will not turn backward when the force is applied by the pinion. This is an important factor in railway coaling stations, as it may often prevent the inadvertent dropping of a ton or ton and a half coal bucket.

NEW MUDGE MOTOR CAR

A new inspection motor car known as the "Power Queen," which is equipped with a 6-h.p. engine and embodies a number of improved features, is being placed on the market by Mudge & Co., Chicago. The motor is of the two-cycle air-cooled type similar to those used on the 4-h.p. inspection cars manufactured by this company. The cylinder has a bore of 4½ in. and a stroke of 5 in., the power being developed under the slow duty of 600 r. p. m. The motor has only three moving parts, cams, valves, chains and belts having been eliminated. The cylinder is indicated at the figure 11 on the accompanying illustration, being supported for its full length between the double lower rails of the car frame. The oval gasoline tank is shown at 12 just above the motor, the raised operating table making possible the use of a 4-gal. tank which provides power for a trip of 250 miles.



"Power Queen," New Mudge Motor Car.

In the design of the car frame and fittings a number of special safety features have been introduced. The guide wheels are tied together by two rods instead of one as formerly, grab irons are provided on both sides of the seat board, marked 3 in the illustration, hand rails, marked 5, serve to keep the passengers off the control levers and the floor boards, marked 9, cover completely the space between the tool tray and the car body, preventing passengers from tripping on the guide arms or getting their feet caught in any open space. These boards can be removed as a unit by loosening thumb screws. The main rails of the frame are of ash and the cross arms are of one piece iron extending through both double lower rails. These arms are inclined slightly toward each other at the outer end to increase the rigidity of the frame. The handles on this car have been placed on the upper rails instead of the lower, enabling the car to be removed without undue bending. The car is equipped with spiral spring cushions and a tool tray of ample length.

Alonzo Pawling, one of the founders of the Pawling & Harnischfeger Co., Milwaukee, Wis., cranes and hoists, left an estate valued at $1,000,000, according to the inventory and appraisal just filed by the executor. The personal property disposed of in the will amounts to $791,236 and the real estate to $259,970.

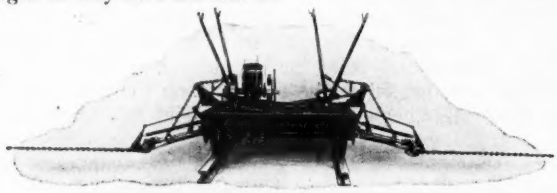
A concrete viaduct is to be constructed at Kansas City, Kan., to carry Eighteenth St. and the street railway tracks over the yards of the U. P. R. R. and the C. R. I. & P. Ry. The roads to bear the cost of construction estimated at $150,000.

William Disston, president of Henry Disston & Sons, Philadelphia, Pa., died suddenly of heart disease on April 5, 1915.

Fairmont Motor Car Mowing Machine

These Cars Are Made by the Fairmont Gas Engine & Railway Motor Car Co., Formerly Fairmont Machine Co., Fairmont, Minn.

A novelty in railway appliances is the motor operated moving machine for cutting weeds and grass along the right of way near the tracks.



Fairmont Motor Car Mowing Machine.

This machine stops expensive scythe work on railroad grades. A section crew of four men with scythes will cut a mile a day, costing about $7.00. The machine cuts 25 miles a day, at a cost of less than $7.00 for wages, gasoline and oil.

One machine covers 500 miles of track in 3 to 4 weeks. As this is done twice a year the saving on 1,000 miles is considerable. If only half this mileage needed cutting, and scythe work cost only $3.50 per mile, the saving would be over $1,500 a year.

Fairmont Motor Car Mowing Machine. Cutter Bars Raised.

Traveling 3 miles per hour it mows a six-foot swath on both sides of the track at once. Either cutter bar can be tilted up or down at any angle, to follow the lay of the ground, which may vary on opposite sides of the track, and either one can be quickly and easily raised to avoid obstructions, or stopped and started without raising.

Fairmont Motor Car Mowing Machine. Cutter Bars Down.

With the cutter bars up and out of gear, used as a motor car, it makes 15 miles per hour. It pulls itself on and off the track at road crossings, as the engine is free from the car. Starts without pushing and the two-speed transmission develops great pulling power.

Contract has been awarded to the Raymond Concrete Pile Co. for placing Raymond concrete piles in the foundation of apartment building for Nels Gross, Delaware place, near Seneca street, Chicago, Ill. William Ernest Walker, architect.

The Maryland Steel Co., of Sparrows Point, Md., has awarded contract to the Raymond Concrete Pile Co. for building marine railway at their plant.

Contract has been awarded to the Raymond Concrete Pile Co. by the McLennan Construction Co., Chicago, for placing concrete piles for the Hardy Apartment at 200 East Delaware place, Chicago, Ill. Chatton & Hammond, architects.

The Raymond Concrete Pile Co. has been awarded the contract for placing concrete piling for the foundation of the Union National Bank building, Cleveland, O. Walker & Weeks, architects. Crowell-Lundoff-Little Co., general contractors.

The merchantable timber acquired by the federal government in the purchase of land for National Forests in the White Mountains of New Hampshire and the Southern Appalachians amounts to more than a billion board feet, worth upward of $3,000,000 on the stump, according to an appraisement by the Forest Service. In addition, there is an enormous quantity of inaccessible and widely scattered timber which can not be considered marketable until regional developments and improvements place it within reach.

Plans for cutting some of this timber in accordance with scientific forestry methods already have been prepared and in a few localities operations have been started. In some places it has been found necessary to remove mature trees in order to give the young growth a chance. This work is being done largely by local residents, who have bought the stumpage and are converting it into lumber. The construction of roads and trails is making more and more timber accessible to lumber operators, but the principal use of these improvements at present is for local communication, fire protection, and to open up the wild land for recreation use. A secondary influence of the improvements is to increase the value of the land and to make the timber on it more accessible and valuable to operators.

A great deal of the forest land within the purchase areas was cut over or culled before the government acquired it. Nearly all of this class of land, however, is covered now with young growth and even the abandoned farm acreage, which forms about two per cent of the whole, is slowly reverting to forest.

Of mature timber which could be placed on the market at once, the eastern national forests contain a total of about 1,100,000,000 board feet, which includes all the common eastern hardwoods, together with much spruce, a good deal of hemlock, and some pine. The land, including the timber, has been bought at an average price of a little more than $5 an acre. More than 5,000,000 acres of this land will eventually be acquired for national forests in the east, if the recommendation made by the National Forest Reservation Commission in its last annual report is carried out.

The Chicago Pneumatic Tool Co. announces the removal of two of its branch offices. The New York office, formerly at 50 Church street, is now at 52 Vanderbilt avenue, and the Boston office has been removed from 191 High street to 185 Pleasant street.

The Standard Paint Co. has moved its main office in New York from 100 William street to room 572, Woolworth building.

A. G. Shaver, recently signal engineer of the Rock Island Lines, has opened an office in the Transportation building, Chicago, as consulting electrical and signal engineer.